

ATTACHMENT 1

ALCATEL LUCENT TEST REPORT

Global Product Compliance Laboratory
600-700 Mountain Avenue
Room 5B-108
Murray Hill, New Jersey 07974-0636 USA

LightSquared High Precision and Timing GPS Receiver Susceptibility Testing

Client

LightSquared

Product Evaluated

**GPS HPT Receivers
and GPS Antennas**

Report Number

GPCL-2011-0158-LS

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Revisions

Date	Revision	Section	Change

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1. System Information And Requirements

Device Under Test: Various High Precision GPS Receivers from different vendors.
(DUT)

Measurement Procedure(s): ANSI C63.4 (2003)

Test Date(s): November 21 – December 21, 2011

Test Performed By: Alcatel-Lucent Bell Labs
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1.1 Introduction

The Device Under Test (DUT) are various GPS receivers that are used in High Precision GPS positioning and measurement applications such as agriculture, surveying and construction. Tests were conducted to determine the DUT's susceptibility to the proposed L-band LTE transmission signals of LightSquared Inc when tested with antennas with and without an integral band-pass filter circuit..

1.2 Purpose and Scope

The purpose of this document is to provide the test measurements and results, which were performed on the DUTs in accordance with the Precision and Timing Receiver LightSquared L-Band LTE, Test Plan version 1.4. The testing was done to check the performance of commercially available GPS devices that were tested with antennas that have been modified with a filter to prevent the LightSquared LTE signals from interfering with the operation of the GPS units. The test results for the modified antenna were compared to the test results of an unmodified antenna.

This document contains the following information:

- Description of the Equipment under Test (or apparatus) to which it refers.
- References to the test specification(s).
- Description of the test facilities and test environment.
- Applied test methodology
- Test configuration and performance criteria.

1.3 Executive Summary

The test results demonstrate that commercial GPS devices attached to a modified antenna did not show a degradation of C/No performance and other KPI's when subjected to a base station interference signal at a level of -15 dBm. The GPS devices connected to an unmodified antenna did show various degradations. When subjected to the handset interfering signals the GPS devices connected to the modified antennas showed no C/N performance degradation at -15 dBm. When the GPS devices were connected to an unmodified antenna, degradations were observed. In addition to the test plan, a worst case scenario of base station and handset, both at -15 dBm, at the device was performed. On the device tested with this condition with the modified antenna, no reduction in C/No was observed.

1.4 Reference Documents, Test Specifications & Procedures

Precision and Timing Receiver LightSquared L-Band LTE, Test Plan version 1.4.

1.5 Applicable Standards

A list of the applicable documents is provided herein:

- ANSI C63.4 (2003) entitled: “American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz”, American National Standards Institute, Institute of Electrical and Electronic Engineers, Inc., New York, NY 10017-2394, USA.

1.6 Tests Conducted

The DUT's were tested per the attached test descriptions. The results reported in this report are for the tracking, tracking sensitivity and acquisition tests. Due to time constraints, not all tests were performed on all of the DUTs.

1.7 Product Descriptions

The devices tested were High Precision GPS devices that are used in applications such as agriculture, surveying and construction, these GPS devices were supplied by LightSquared.. The antennas provided were JAVAD antennas which were unmodified or modified filter to prevent the LightSquared LTE frequencies from interfering with the GPS device operation.

The following are the products that were available to be tested.

	Manufacturer	Model
GPS Units	JAVAD	Triumph VI
	Topcon	NET-3GA
Antennas		
	Javad Modified	GrAnt-G3T
	Javad Unmodified	GrAnt-G3T

Test results are only being reported for the JAVAD and TOPCON GPS units in this version report.



12586 AND 17641 and 17169 GPS UNITS

1.8 Test Procedures

This is a general overview of the specified tests that were conducted. Not all tests were conducted at all test signal levels, timing of the application of interference signals and starting test levels were modified as needed to complete testing in allotted time. Complete and specific details can be found in the test plan.

There are three types of tests to be conducted they are as follows:

- Tracking
- Tracking Sensitivity
- Acquisition

1.8.1 Tracking Test Procedure

For each GPS device, the tracking tests were first executed with un-modified external antenna to establish the reference case and then with the modified antenna capable of rejecting LightSquared interference.

This test case was started after all receivers were tracking all GPS satellites for at least 1 minute.

For test configurations 1-3 and d9-11 of the LTE base station configurations specified in section 4.8.1 of the test plan, the following procedure was performed with the GPS simulator set up as the test plan.

- 1) Record the performance parameters for each DUT.
- 2) Set the LTE simulator for the selected configuration to an output power of -60 dBm (at the receivers).
 - a) Record the performance parameters for each DUT.
 - b) Increase the power of the LTE simulators output by 2 dB.
 - c) Repeat steps 2a) and 2b) until the output power of the LTE simulators has reached -10 dBm at the device.
- 3) Dwell at MAX dBm for two minutes.
- 4) Set the LTE simulator the selected configuration to an output power of -10 dBm.
 - a) Record the performance parameters.
 - b) Decrease the power of the LTE simulator output by 1 dB.
 - c) Repeat steps 4a) and 4b) until the LTE simulator power is set to MIN dBm.

1.8.2 Sensitivity Tracking Test Procedure

This test case was started after the receiver was tracking all GPS satellites for at least 1 minute.

For two configurations 1 and 6 from section 4.8.1 of the test plan the following procedures were performed with the GPS simulator set up for AGNS 24 Space Vehicles (SVs) Spec Constant Power

- 1) With LTE simulator power off collect 15 minutes of tracking performance parameters.
- 2) For each LTE power level from -35 dBm to -5 dBm in 5 dB steps:
 - a) Set the power level of the simulators to the specified power.

- b) Continuously record performance data during 2).
- c) Reduce GPS simulator power at a rate of 5 dB/min.
- d) Set the GPS simulator back to nominal signal level.
- e) Turn the LTE simulator power off.
- f) Wait 2 minutes to allow all DUTs to stabilize.

1.8.3 Acquisition Test Procedure

This test case was done from a “warm” start condition. The intent was that a normal acquisition processes be conducted between restarts, one that results from having ephemeris and position, but not precise GPS time (bit sync unknown).

For two configurations 1 and 6 from section 4.8.1 of the test plan the following procedures were performed with the GPS simulator set up for AGNS 24 SVs Spec Constant Power

- 1) Power on device and record performance data for 5 minutes.
- 2) For each LTE power level from -30 dBm to -15 dBm in 10 dB steps:
 - a) Record performance data for 15 minutes.
 - b) During each 15 minute test, force restart of the receiver at least every 3 minutes. A minimum of 4 restarts should be initiated at each power level.

1.9 Calibration and Setup Procedures

1.9.1 GPS Simulator Transmit Level

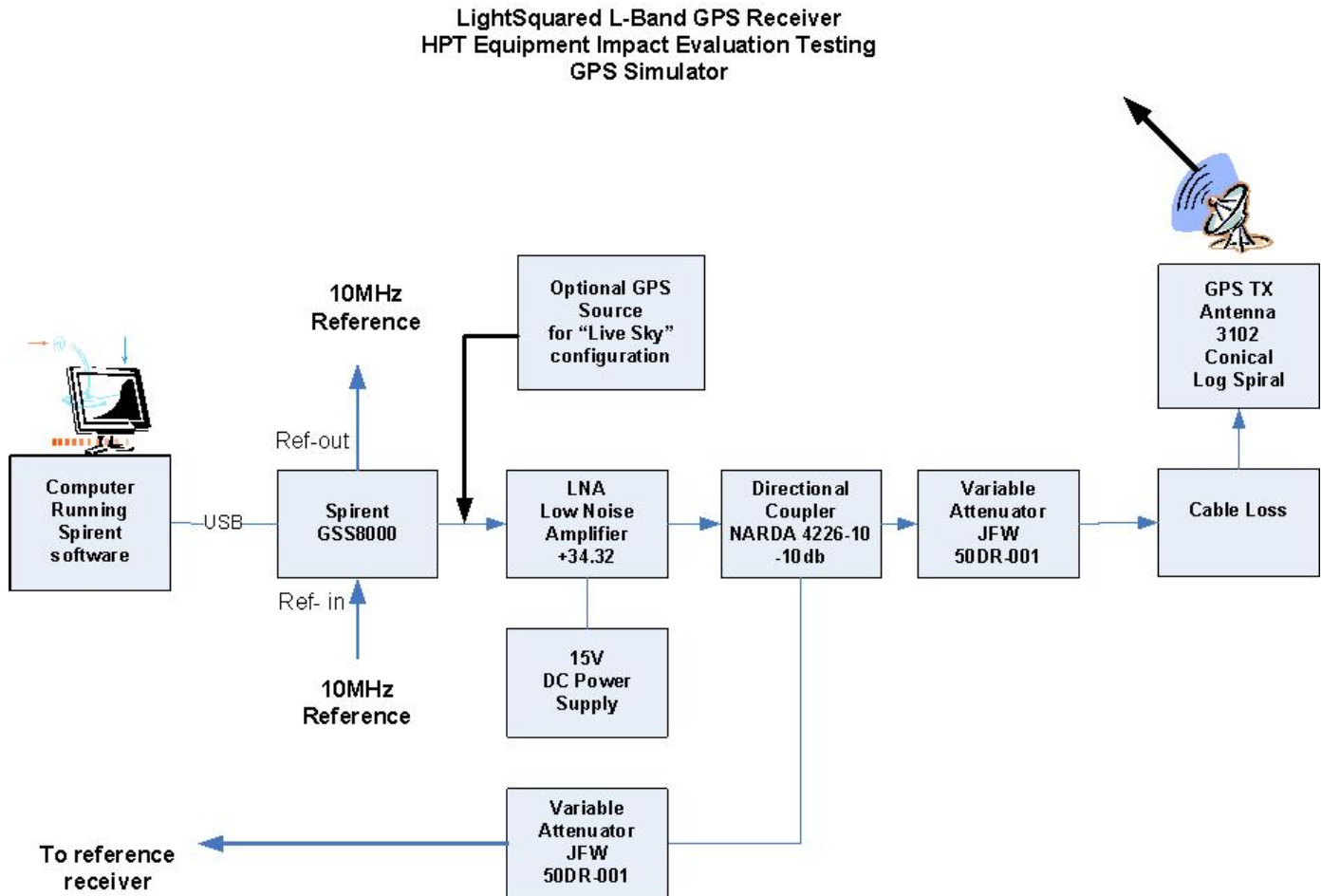
The output level of the Spirent GNSS simulator was adjusted to obtain a C/No value of 47 for the device under test, this is calculated to be approximately -130 dBm at the device.

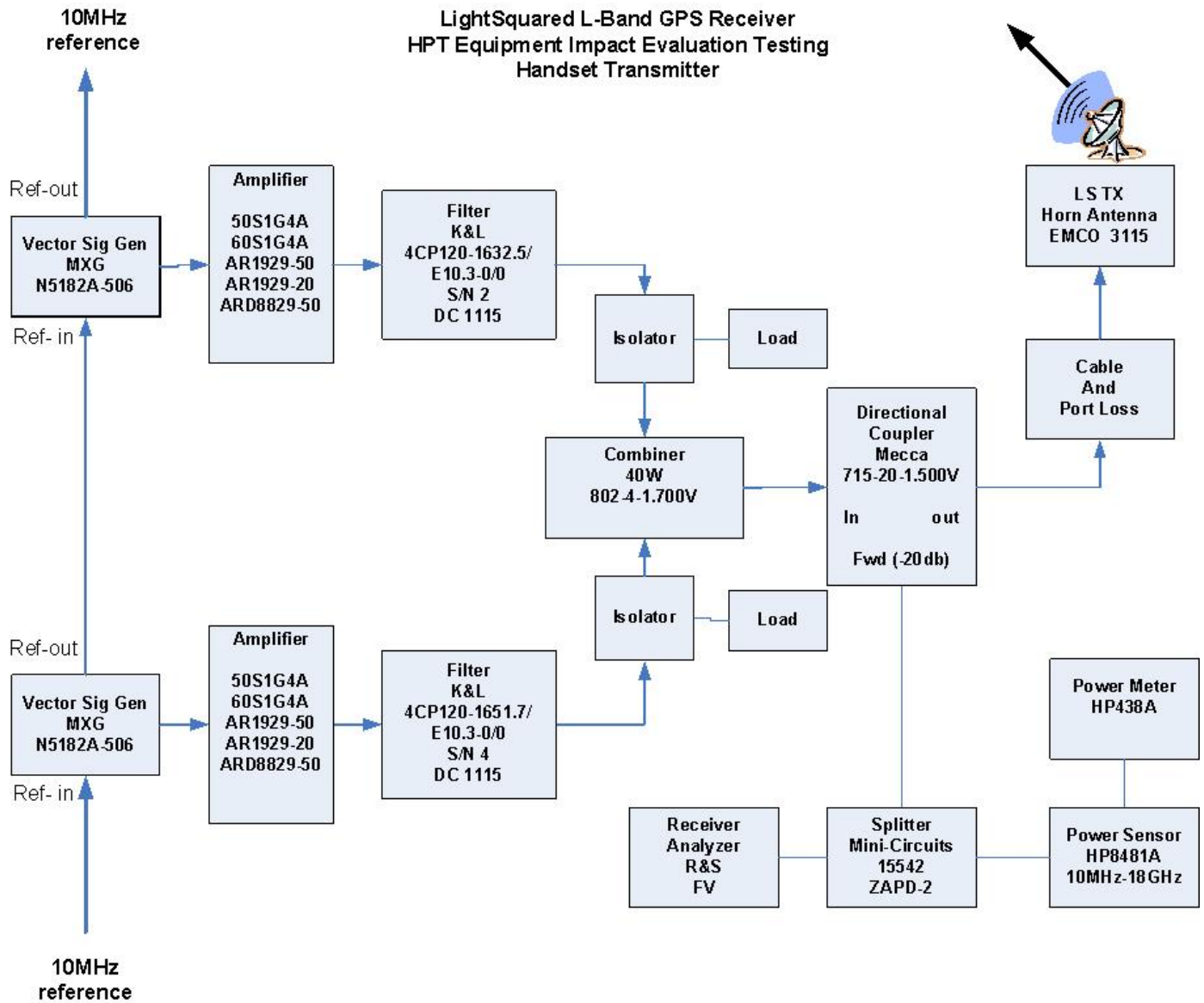
1.9.2 Live Sky Calibration Procedure

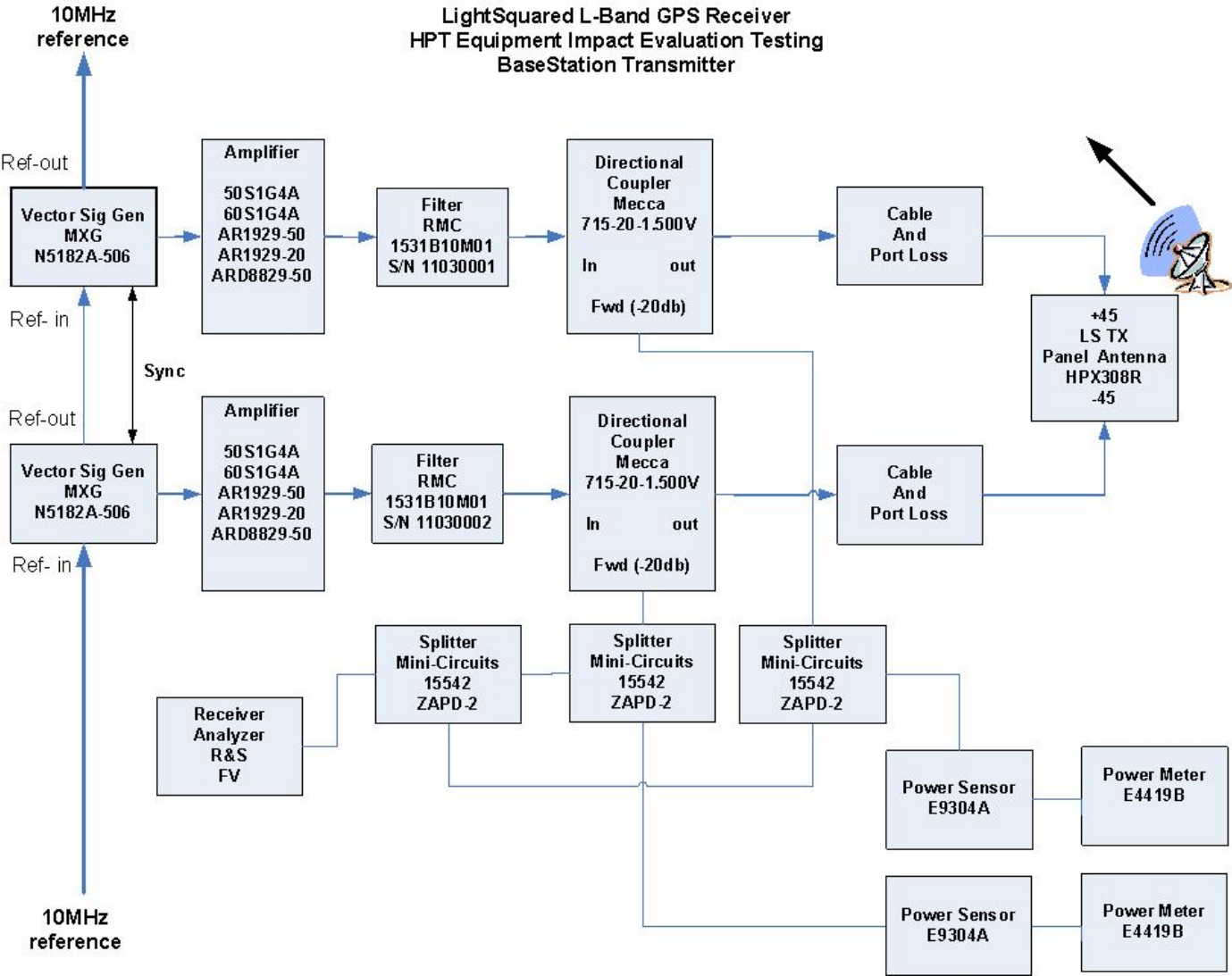
- 1. The reference antenna stand was setup outside the building with a southern exposure. If available, the unmodified antenna was used as the reference antenna.
- 2. The portable GPS receiver was connected through a short cable to the reference antenna and the C/No values were documented.
- 3. The reference antenna was then connected to the GPS environment simulator.
- 4. The DUT was then connected to the antenna under test in the chamber.
- 5. The GPS environment simulator was then adjusted to obtain the same GPS C/No values as in step 2.
- 6. The DUT was then tested per the desired test (tracking, reacquisition, etc) procedures.

1.10 Test Configuration

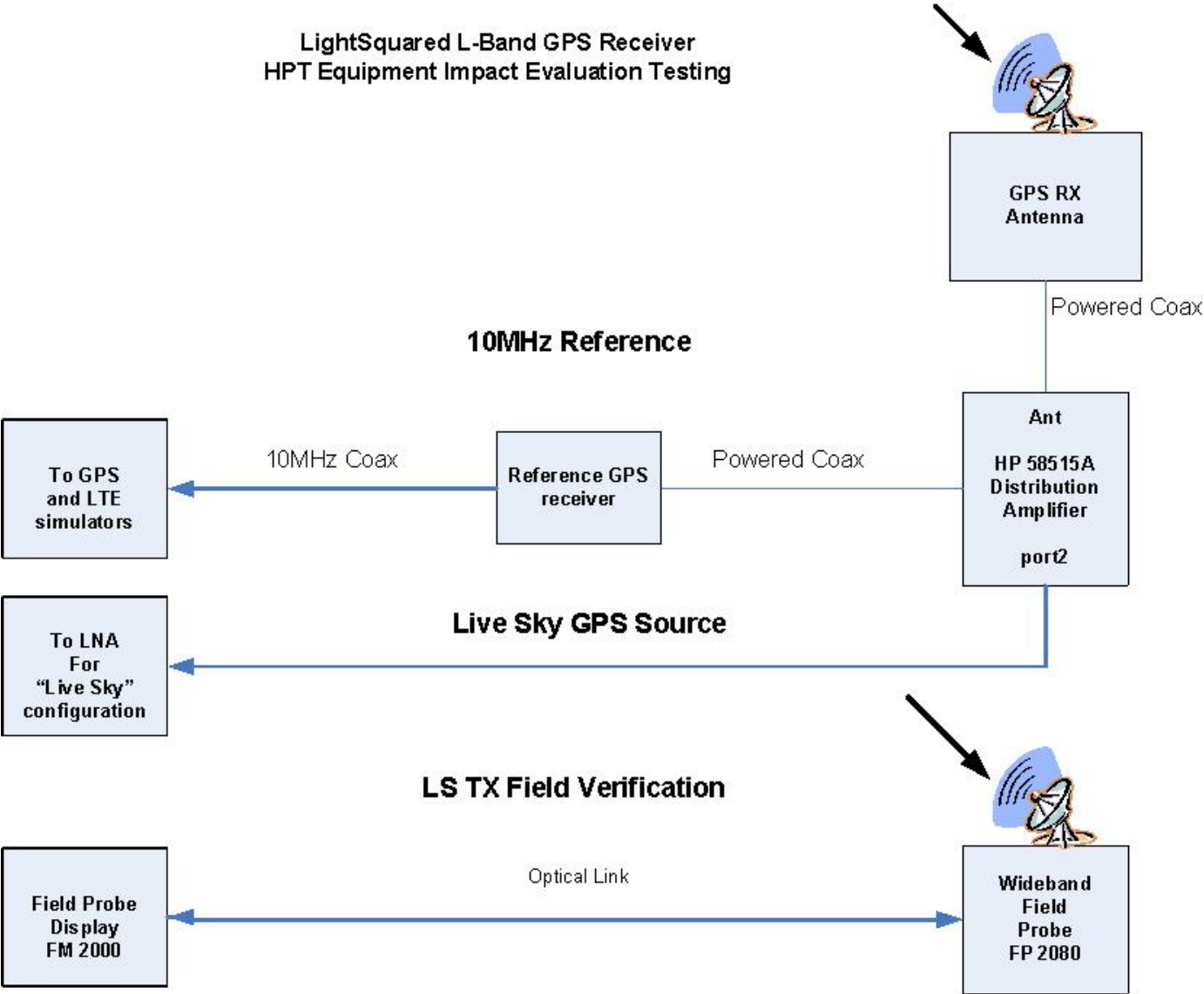
1.10.1 Electrical Configuration





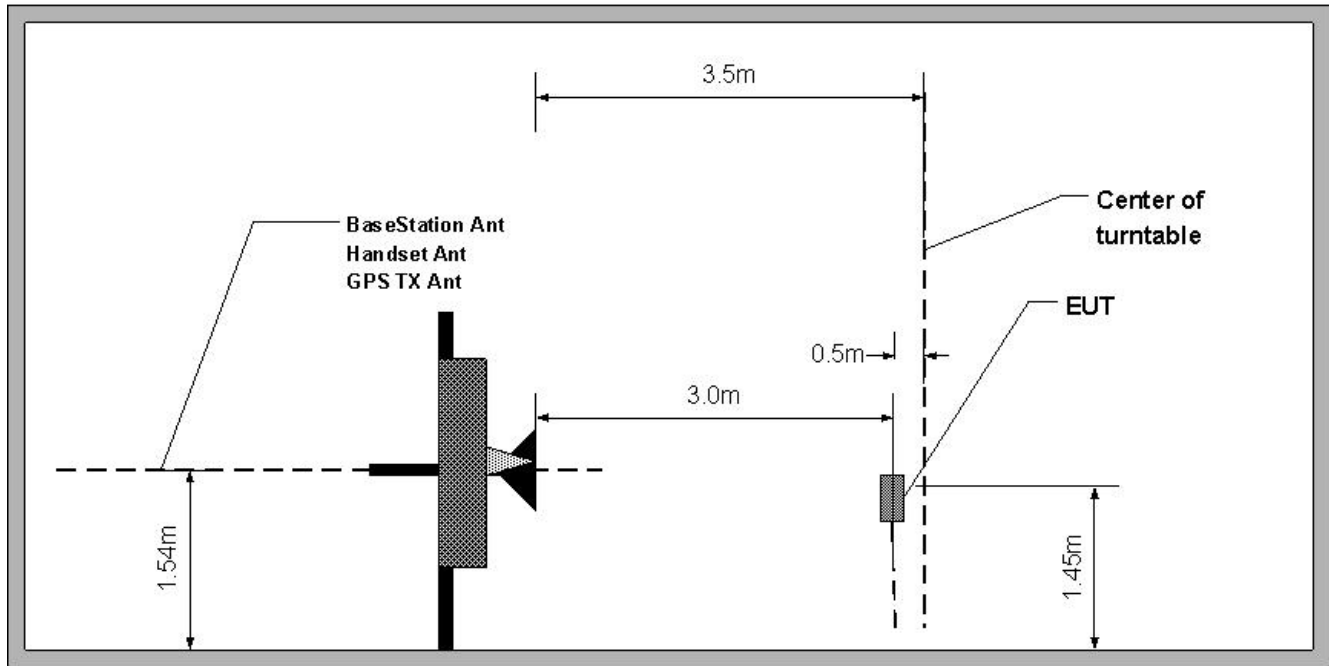


LightSquared L-Band GPS Receiver
HPT Equipment Impact Evaluation Testing

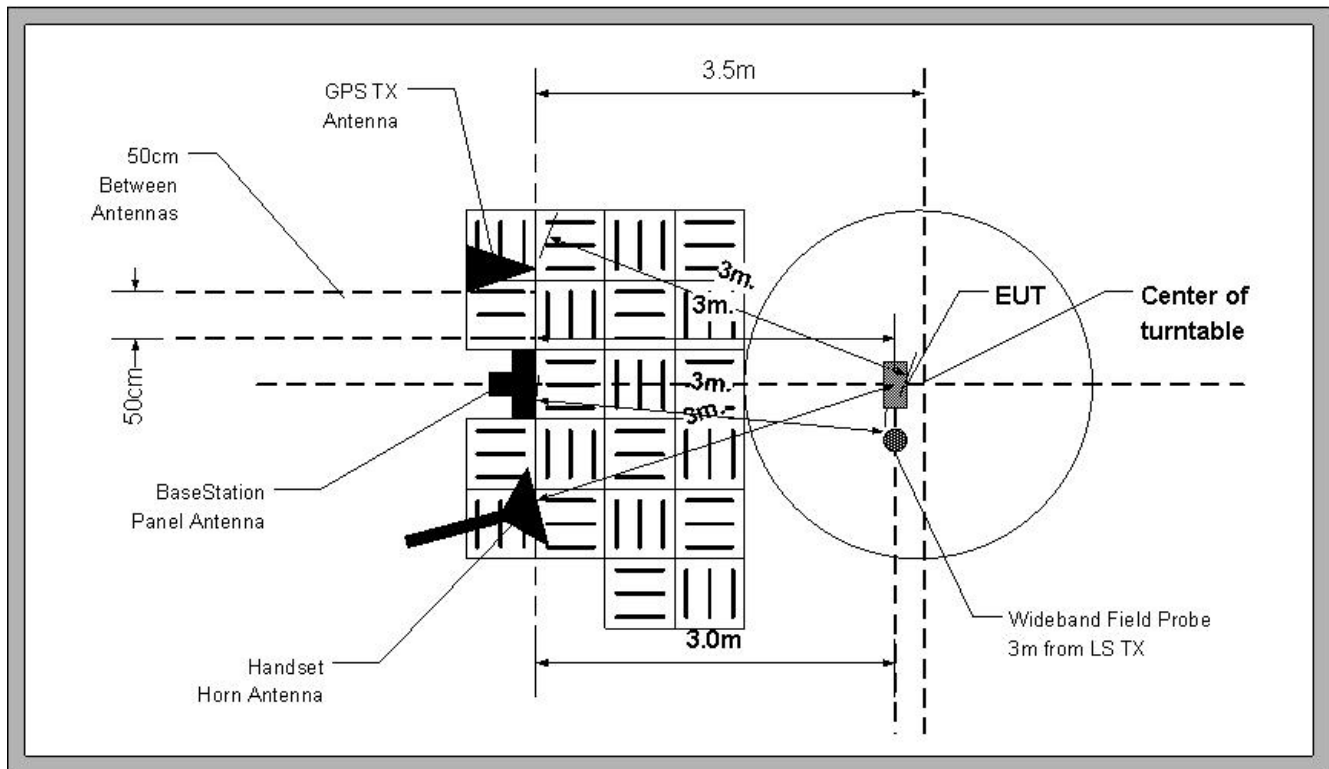


1.10.2 Physical Configuration

Physical Test Configuration in AR4 (Side View)



Physical Test Configuration in AR4 (Top View)



1.11 Test Facilities

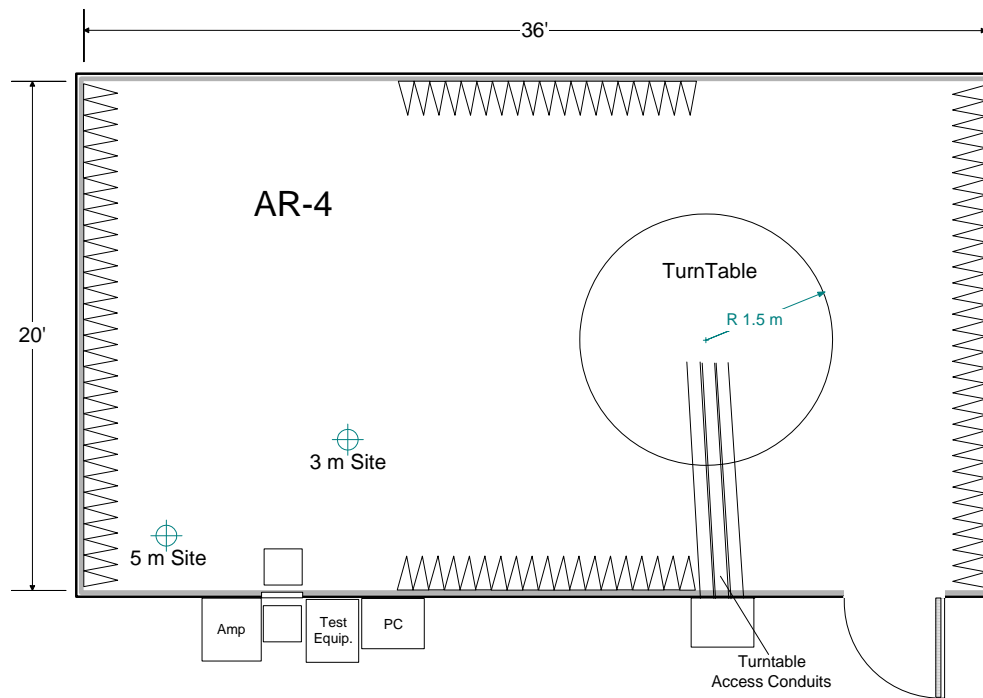
Murray Hill AR-4

The AR-4 chamber is a Panashield 3/5 meter compliance chamber. This chamber is a self supporting modular RF shielding design with nominal dimensions of 6.3m W x 11.1m L x 5.4m H. The walls and ceiling are treated with FFG-1000 & FFG-2000 TOYO grid ferrite treatment. In the specular regions HY-35 hybrid absorber is mounted on ferrite. A removable FFG-1000 ferrite tile grid 3.6m W x 3.3m D is placed between the EUT and antenna during radiated immunity testing. In addition, TDK ICM-006 absorber are installed for 1 to 18 GHz mid range performance. The operational frequency range of the chamber is 30 MHz to 18 GHz. The chamber is single point grounded to a ground rod/ground array.

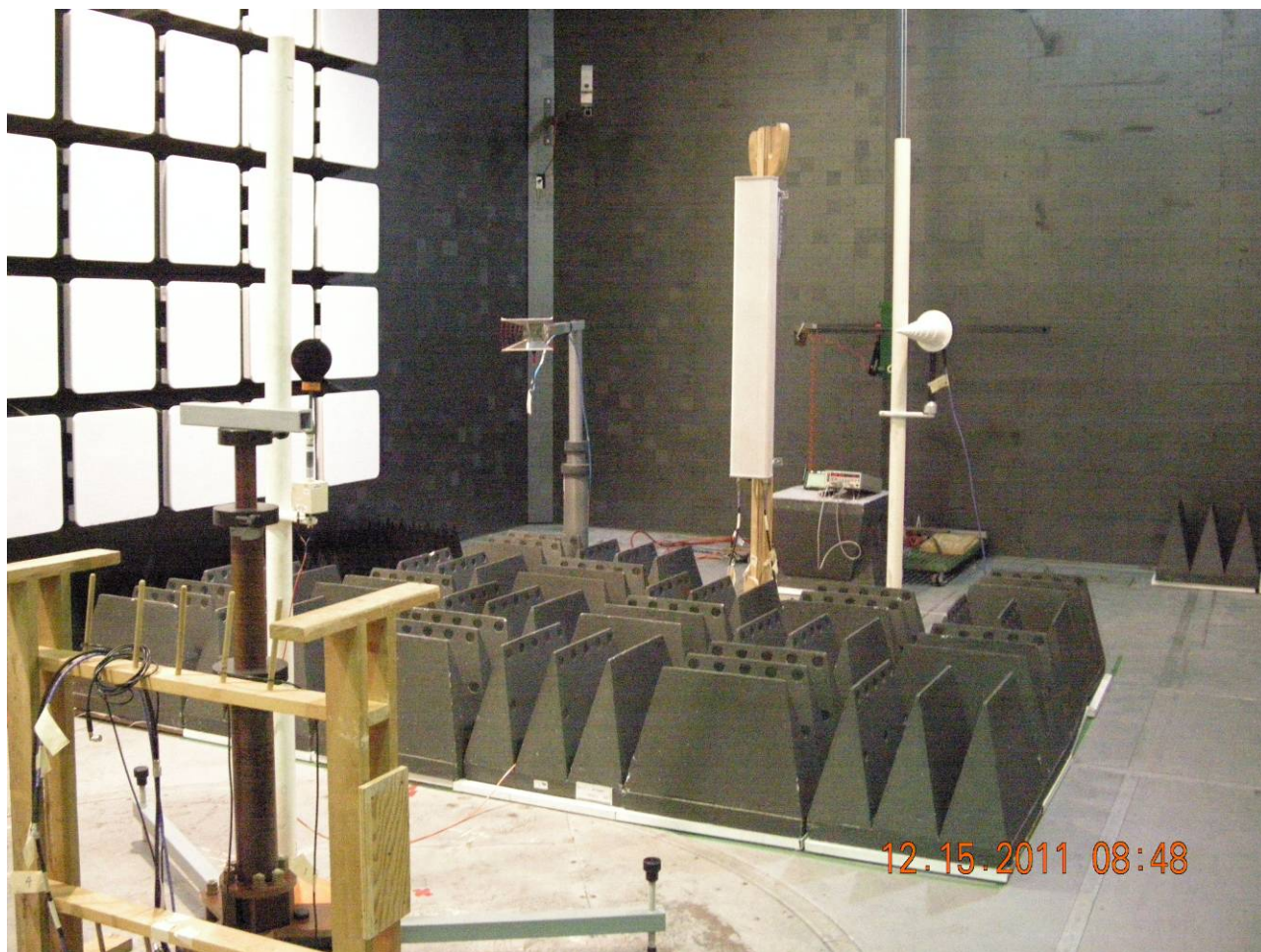
Access to the chamber is provided with a 1.2m W x 2.4m H RCM auto-latch door. The chamber is provided with a 3 meter variable speed 8800 LB capacity turntable, and a 4 meter antenna mast. Measurement distances of 3 and 5 meters can be achieved with an antenna search height of 4 meters. RF Line Filters are installed on the on the power input lines to remove RF ambient signals. These filters are encased in shielded electrical enclosures. Access from outside the chamber to the center hub of the turntable is provided via 3 6" metallic conduits. The turntable is positioned so that an EUT will have a minimum setback distance of 1 meter from the side walls and ceiling during testing.

The chamber is outfitted with three recessed access boxes. From these boxes RF cables are run under the raised flooring to a bulkhead feed-thru panel and out to a breakout panel adjacent to the test instrumentation. The raised flooring inside the chamber is constructed with modular shielding panels interconnected in the same fashion as the chamber walls. 1/8" galvanized steel plates are used between the batten strips to flush out the flooring. The chamber lighting and wall treatments are specifically designed to provide an office like work environment inside the chamber. A closed circuit color CCTV system shielded to 200 V/m is installed to allow monitoring of the EUT. A dedicated HVAC system with humidity control provides a constant temperature and humidity inside the chamber.

All power entering the chamber is filtered. The filters provide 100 dB insertion loss from 10 kHz to 10 GHz IAW with MIL-STD-220A. Dedicated power is provided in the center hub of the turntable for the EUT's.

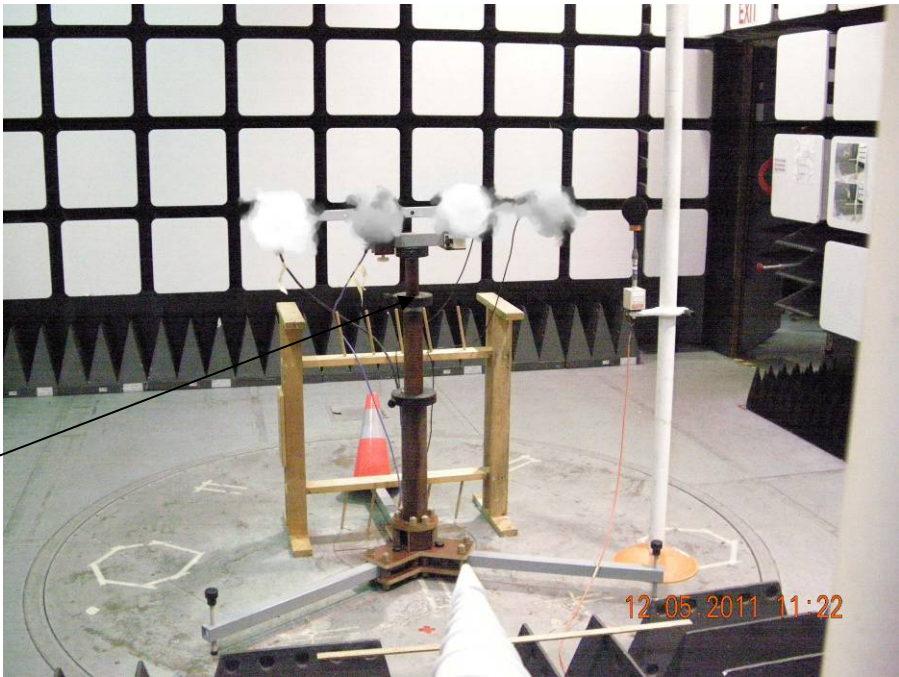


1.11.1 Pictures of Test Facilities



Alcatel-Lucent
AR-4

Antenna
Mounting
Fixture



Handset
Antenna

Field
Probe



LS Production
SLB Antenna

LTE Tx
Antenna

AR-4 GPS Test Setup



Live Sky Antenna Setup

1.12 Equipment Lists

Murray Hill Equipment List

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
Spectrum Analyzer 10HZ-3.6GHZ	101993	Rohde & Schwarz	FSV3	4/6/2011	4/27/2012
Spectrum Analyzer 10HZ-3.6GHZ	101994	Rohde & Schwarz	FSV3	4/7/2011	9/7/2012
MXG Vector Signal Generator	MY50140028	Agilent	N5182A	4/18/2010	4/29/2012
MXG Vector Signal Generator	MY50142654	Agilent	N5182A	10/22/2011	11/15/2014
MXG Vector Signal Generator	MY47420542	Agilent	N5182A	11/15/2011	11/15/2014
MXG Vector Signal Generator	MY50140842	Agilent	N5182A	11/1/2011	11/15/2014
Band Pass Filter	11030001	LightSquared	1531B10M01	NA	NA
Band Pass Filter	11030002	LightSquared	1531B10M01	NA	NA
Band Pass Filter	2	K&L	4CP120-1632.5	NA	NA
Band Pass Filter	4	K&L	4CP120-1651.7	NA	NA
Multiclass satellite simulator	8792	Spirent	GSS8000	NA	NA
30 Amplifier 0.8 – 3.0 GHz 50 Watts	30752	Amplifier Research	30S1G3M3	NA	NA
25 Watt Amplifier	21071	Amplifier Research	25S1G4	NA	NA
50 Watt Amplifier	N1C5A00-1039	Comtech-PST	ARD 8829-50	NA	NA
20 Watt Amplifier	M3D7A00-114	Comtech	ARD 1929-20	NA	NA
Power Meter	3513U03984	Hewlett Packard	438A	4/13/2011	4/13/2012
Power Meter	3513U04024	Hewlett-Packard	438A	8/18/2011	8/18/2012
Power Meter	GB42420582	Agilent	E4419B	3/11/2010	3/11/2012
Power Meter	GB39513585	Agilent	E4419B	5/25/2010	6/17/2012
Power Sensor	US37290578	Hewlett Packard	8481A	2/24/2011	2/24/2012
Power Sensor 10 MHz- 18 GHz	2702A81114	Agilent	8481A	3/29/2011	3/29/2012
6GHz Power sensor	MY51070079	Agilent	E9304A	2/23/2011	4/18/2012
6GHz Power sensor	MY41496465	Agilent	E9304A	10/6/2011	11/15/2012
Isotropic Field Monitor	23282	Amplifier Research	FM 2000	NA	NA
Isotropic Field Probe 80 MHz-40 GHz	28124	Amplifier Research	FP 2080	4/7/2011	4/7/2012
Amplifier	NA	Alcatel-Lucent	1-2GHz Amp	NA	NA
Spiral Antenna	00128329	ETS-Lindgren	3102L	11/19/2010	5/19/2012
Double Ridged Horn Antenna 1-18GHz	9006-3460	EMCO	3115	1/12/2011	1/12/2012
Antenna – Single Band Panel, Dual Polarization 1525-1710 MHz	67570033 FE110901738	Argus	HPX308R HPX308R/T-115GL	NA	NA
Temperature and Humidity Gauge	CH06464	Extech	RH520	7/20/2011	7/20/2012

Description	Serial Number	Manufacturer	Model	Cal. Date	Cal. Due
30dB Attenuator	BB0447	Weinschel	47-3043	NA	NA
Attenuator	271294	JFW Industries	50DR-001	NA	NA
Attenuator	399511	JFW Industries	50DR-001	NA	NA
Directional Coupler	02828	Narda	4226-10	NA	NA
10 MHz Source	5650516	Feizar, Inc	GPStar 565-201-501	NA	NA
GPS Distribution	3731	Hewlett Packard	5815A	NA	NA
Power Supply	KR61313976	Hewlett Packard	E3610A	NA	NA
Power Supply	KR40606846	Hewlett Packard	E3611A	NA	NA

1.13 Test Bed Calibration and Measurement Calculations

1.13.1 DownLink

Bell Labs LightSquared HPT - GPS Test Bed Calibration - BaseStation										CM/NPA	17-Nov-11
					Maximum LightSquared TX Power:	62	dBm EIRP		(downlink)		
					Test Antenna Separation:	3	Meter				
					Antenna Front-Back Isolation:	30	dB				
					Radiating Antenna Gain:	14.8	dB				
					Free space loss frequency:	1531	MHz				
					Test Bed Power Meter Offset:	20	dB				
								Equivalent	Equivalent	Equivalent	
	Raw	LTE TX	LTE TX	Propgation	Power	Power	Boresight	Boresight	off-lobe		
	Pwr Mtr	Power	EIRP	Loss	at device	diff	Distance	Distance	Distance	LTE Tx	
Notes	dBm	dBm	dB	dB	dBm	dB	Meters	Feet	Meters	W	
1	-25.0	-5	9.8	45.6	-35.8	97.8	1222	4009	38.6	3.16E-04	
	-24.0	-4	10.8	45.6	-34.8	96.8	1089	3573	34.4	3.98E-04	
	-23.0	-3	11.8	45.6	-33.8	95.8	971	3184	30.7	5.01E-04	
	-22.0	-2	12.8	45.6	-32.8	94.8	865	2838	27.4	6.31E-04	
	-21.0	-1	13.8	45.6	-31.8	93.8	771	2529	24.4	7.94E-04	
	-20.0	0	14.8	45.6	-30.8	92.8	687	2254	21.7	1.00E-03	
	-19.0	1	15.8	45.6	-29.8	91.8	613	2009	19.4	1.26E-03	
	-18.0	2	16.8	45.6	-28.8	90.8	546	1791	17.3	1.58E-03	
	-17.0	3	17.8	45.6	-27.8	89.8	487	1596	15.4	2.00E-03	
	-16.0	4	18.8	45.6	-26.8	88.8	434	1422	13.7	2.51E-03	
	-15.0	5	19.8	45.6	-25.8	87.8	386	1268	12.2	3.16E-03	
	-14.0	6	20.8	45.6	-24.8	86.8	344	1130	10.9	3.98E-03	
	-13.0	7	21.8	45.6	-23.8	85.8	307	1007	9.7	5.01E-03	
	-12.0	8	22.8	45.6	-22.8	84.8	274	897	8.7	6.31E-03	
	-11.0	9	23.8	45.6	-21.8	83.8	244	800	7.7	7.94E-03	
	-10.0	10	24.8	45.6	-20.8	82.8	217	713	6.9	1.00E-02	
	-9.0	11	25.8	45.6	-19.8	81.8	194	635	6.1	1.26E-02	
	-8.0	12	26.8	45.6	-18.8	80.8	173	566	5.5	1.58E-02	
	-7.0	13	27.8	45.6	-17.8	79.8	154	505	4.9	2.00E-02	
	-6.0	14	28.8	45.6	-16.8	78.8	137	450	4.3	2.51E-02	
	-5.0	15	29.8	45.6	-15.8	77.8	122	401	3.9	3.16E-02	
	-4.0	16	30.8	45.6	-14.8	76.8	109	357	3.4	3.98E-02	
	-3.0	17	31.8	45.6	-13.8	75.8	97	318	3.1	5.01E-02	
	-2.0	18	32.8	45.6	-12.8	74.8	87	284	2.7	6.31E-02	
	-1.0	19	33.8	45.6	-11.8	73.8	77	253	2.4	7.94E-02	
	0.0	20	34.8	45.6	-10.8	72.8	69	225	2.2	1.00E-01	
	1.0	21	35.8	45.6	-9.8	71.8	61	201	1.9	1.26E-01	
	2.0	22	36.8	45.6	-8.8	70.8	55	179	1.7	1.58E-01	
	3.0	23	37.8	45.6	-7.8	69.8	49	160	1.5	2.00E-01	
	4.0	24	38.8	45.6	-6.8	68.8	43	142	1.4	2.51E-01	
	5.0	25	39.8	45.6	-5.8	67.8	39	127	1.2	3.16E-01	
	6.0	26	40.8	45.6	-4.8	66.8	34	113	1.1	3.98E-01	
	7.0	27	41.8	45.6	-3.8	65.8	31	101	1.0	5.01E-01	
	8.0	28	42.8	45.6	-2.8	64.8	27	90	0.9	6.31E-01	
	9.0	29	43.8	45.6	-1.8	63.8	24	80	0.8	7.94E-01	
	10.0	30	44.8	45.6	-0.8	62.8	22	71	0.7	1.00E+00	
	11.0	31	45.8	45.6	0.2	61.8	19	64	0.6	1.26E+00	
	12.0	32	46.8	45.6	1.2	60.8	17	57	0.5	1.58E+00	
	13.0	33	47.8	45.6	2.2	59.8	15	50	0.5	2.00E+00	
	14.0	34	48.8	45.6	3.2	58.8	14	45	0.4	2.51E+00	
	15.0	35	49.8	45.6	4.2	57.8	12	40	0.4	3.16E+00	
	16.0	36	50.8	45.6	5.2	56.8	11	36	0.3	3.98E+00	
	17.0	37	51.8	45.6	6.2	55.8	10	32	0.3	5.01E+00	
	18.0	38	52.8	45.6	7.2	54.8	9	28	0.3	6.31E+00	
	19.0	39	53.8	45.6	8.2	53.8	8	25	0.2	7.94E+00	
2	20.0	40	54.8	45.6	9.2	52.8	7	23	0.2	1.00E+01	
Notes:	1	Estimated Minimum RF Test Bed Power, equiv. to > 2.4 km to antenna boresight									
	2	Estimated Maximum RF Test Bed Power, equiv. to < 15 m to antenna boresight									

1.13.2 UpLink

Bell Labs LightSquared GPS Test Bed Calibration - Handset					CM/NPA	13-May-11		
	Maximum LightSquared TX Power:		23	dBm EIRP		(uplink)		
	Test Antenna Separation:		3	Meter				
	Antenna Front-Back Isolation:		n/a	dB				
	Radiating Antenna Gain:		8.8	dB				
	Free space loss frequency:		1632.5	MHz				
	Test Bed Power Meter Offset:		20	dB				
Raw	LTE TX	LTE TX	Propogation	Power at device	Power	Equivalent	Equivalent	
Pwr Mtr	Power	EIRP	Loss		diff	Distance	Distance	LTE Tx
dBm	dBm	dB	dB	dBm	dB	Meters	Feet	W
-25	-5	3.8	46.2	-42.4	65.4	27	90	3.16E-04
-24	-4	4.8	46.2	-41.4	64.4	24	80	3.98E-04
-23	-3	5.8	46.2	-40.4	63.4	22	71	5.01E-04
-22	-2	6.8	46.2	-39.4	62.4	19	64	6.31E-04
-21	-1	7.8	46.2	-38.4	61.4	17	57	7.94E-04
-20	0	8.8	46.2	-37.4	60.4	15	50	1.00E-03
-19	1	9.8	46.2	-36.4	59.4	14	45	1.26E-03
-18	2	10.8	46.2	-35.4	58.4	12	40	1.58E-03
-17	3	11.8	46.2	-34.4	57.4	11	36	2.00E-03
-16	4	12.8	46.2	-33.4	56.4	10	32	2.51E-03
-15	5	13.8	46.2	-32.4	55.4	9	28	3.16E-03
-14	6	14.8	46.2	-31.4	54.4	8	25	3.98E-03
-13	7	15.8	46.2	-30.4	53.4	7	23	5.01E-03
-12	8	16.8	46.2	-29.4	52.4	6	20	6.31E-03
-11	9	17.8	46.2	-28.4	51.4	5.5	18	7.94E-03
-10	10	18.8	46.2	-27.4	50.4	4.9	16	1.00E-02
-9	11	19.8	46.2	-26.4	49.4	4.3	14	1.26E-02
-8	12	20.8	46.2	-25.4	48.4	3.9	13	1.58E-02
-7	13	21.8	46.2	-24.4	47.4	3.4	11	2.00E-02
-6	14	22.8	46.2	-23.4	46.4	3.1	10	2.51E-02
-5	15	23.8	46.2	-22.4	45.4	2.7	9.0	3.16E-02
-4	16	24.8	46.2	-21.4	44.4	2.4	8.0	3.98E-02
-3	17	25.8	46.2	-20.4	43.4	2.2	7.1	5.01E-02
-2	18	26.8	46.2	-19.4	42.4	1.9	6.4	6.31E-02
-1	19	27.8	46.2	-18.4	41.4	1.7	5.7	7.94E-02
0	20	28.8	46.2	-17.4	40.4	1.5	5.0	1.00E-01
1	21	29.8	46.2	-16.4	39.4	1.4	4.5	1.26E-01
2	22	30.8	46.2	-15.4	38.4	1.2	4.0	1.58E-01
3	23	31.8	46.2	-14.4	37.4	1.1	3.6	2.00E-01
4	24	32.8	46.2	-13.4	36.4	1.0	3.2	2.51E-01
5	25	33.8	46.2	-12.4	35.4	0.9	2.8	3.16E-01
6	26	34.8	46.2	-11.4	34.4	0.8	2.5	3.98E-01
7	27	35.8	46.2	-10.4	33.4	0.7	2.3	5.01E-01
8	28	36.8	46.2	-9.4	32.4	0.6	2.0	6.31E-01
9	29	37.8	46.2	-8.4	31.4	0.55	1.8	7.94E-01
10	30	38.8	46.2	-7.4	30.4	0.49	1.6	1.00E+00
11	31	39.8	46.2	-6.4	29.4	0.43	1.4	1.26E+00
12	32	40.8	46.2	-5.4	28.4	0.39	1.3	1.58E+00
13	33	41.8	46.2	-4.4	27.4	0.34	1.1	2.00E+00
14	34	42.8	46.2	-3.4	26.4	0.31	1.0	2.51E+00
15	35	43.8	46.2	-2.4	25.4	0.27	0.9	3.16E+00
16	36	44.8	46.2	-1.4	24.4	0.24	0.8	3.98E+00
17	37	45.8	46.2	-0.4	23.4	0.22	0.7	5.01E+00
18	38	46.8	46.2	0.6	22.4	0.19	0.6	6.31E+00
19	39	47.8	46.2	1.6	21.4	0.17	0.6	7.94E+00
20	40	48.8	46.2	2.6	20.4	0.15	0.50	1.00E+01
Notes:	1	Estimated Minimum RF Test Bed Power, equiv. to 90 ft to LTE mobile						
	2	Estimated Maximum RF Test Bed Power, equiv. to 6 inches to LTE mobile						

2. TEST DATA

Attachment A – Table of Tests Performed
Attachment B – Base Station Tracking with simulated signal
Attachment C – Handset Tracking
Attachment D – Base Station – Handset Signals Combined Tracking
Attachment E – Base Station Tracking with live signal
Attachment F – Acquisition
Attachment G – Sensitivity

ATTACHMENT A
(Table of Tests Performed and Test Summary)

1. Checkmark indicates the test was performed.

2. Information in the cells indicates the signal levels tests and the steps between each signal level tested.

DUT	Configurations 1-3 Simulated Live Sky 1) Base Station only 2) Handset only 3) BaseStation & Handset 4-6Live Sky 9) Base Station only 10) Handset only 11) BaseStation & Handset	Tracking -85dbm to -15dbm Ramp Up/Down Step 1dbm Configurations 0-3, 5-7, 9-11	Tracking Sensitivity -85dbm to -15dbm Step 5db Step 1db Dwell 1min Configurations 1,6	Acquisition "warm" start -85dbm to -15dbm Step 10db Restart every 3 min Configurations 1,6
12586 – with Modifed Antenna	1	✓ 2dbm step -35dbm to -19dbm And back to -35dBm	✓ Interference -30dbm, -24dbm, GPS Level -130dbm to -145dbm	✓ Step 6,4,5db -30dbm to -15dbm
17169 with Unmodified Antenna	1	✓ 5dbm step -35dbm to -19dbm	✓ Interference -30dbm, -24dbm, - 15dbm GPS Level -130dbm to -150dbm	✓ Step 6,4,6db -30dbm to -14dbm
17641 with Unmodified Antenna	1	✓ 2dbm step -35dbm to -10dbm	✓ Interference -30dbm, -24dbm, - 15dbm GPS Level -130dbm to -155dbm	✓ Step 6,4,6db -30dbm to -14dbm
17169 with Modified Antenna	1	✓ 2dbm step -35dbm to -10dbm	✓ Interference -30dbm, -24dbm, - 15dbm GPS Level -130dbm to -155dbm	✓ Step 6,4,5db -30dbm to -15dbm

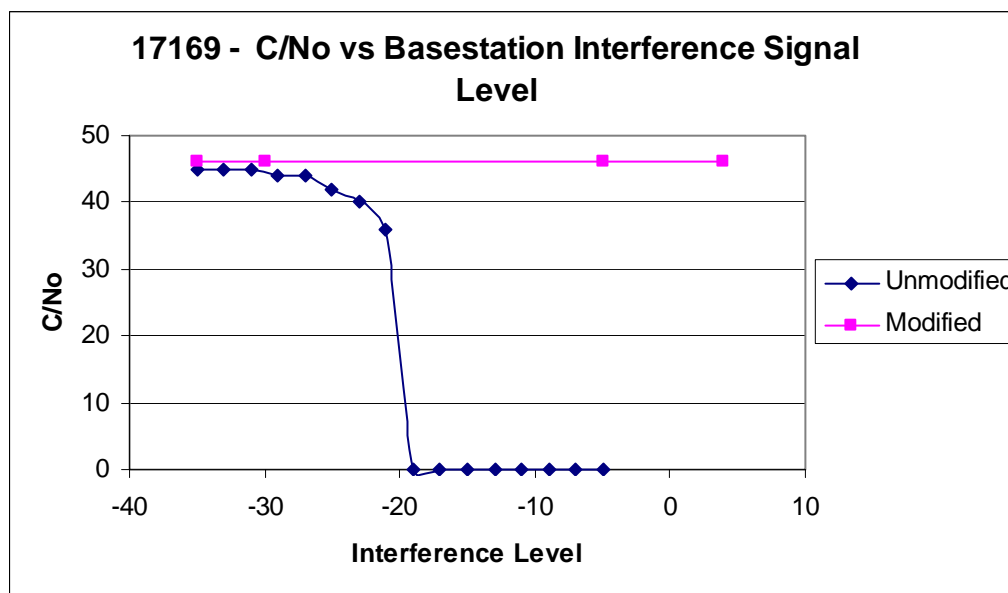
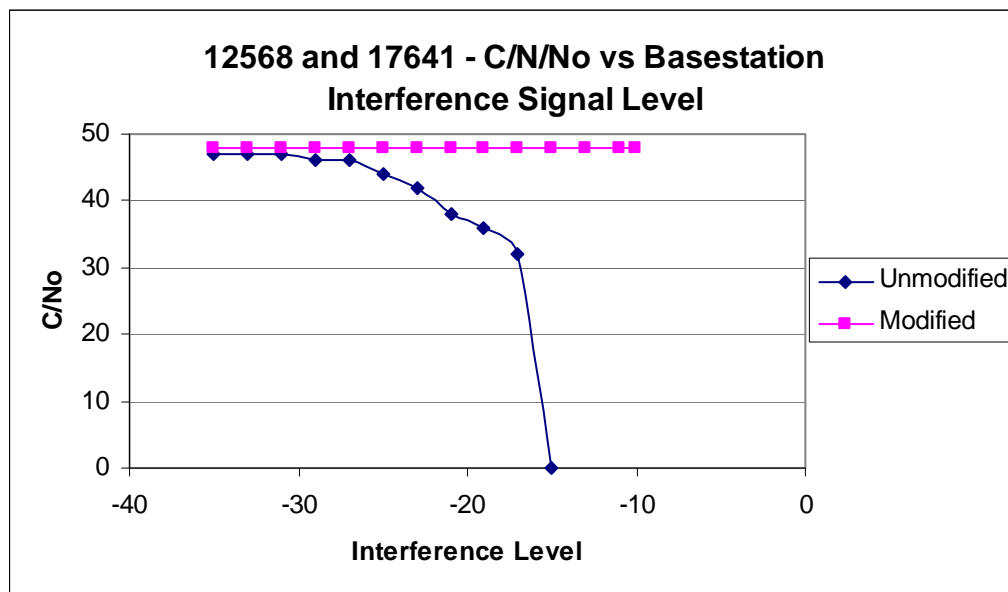
12586 – with Modifed Antenna	2	✓ 2 dBm Steps -37 to -15 and then returned to -37 dBm		
17641 – with Umodified Antenna	2	✓ 2 dBm Steps -37 to -15 and then returned to -37 dBm		
12586 – with Modifed Antenna	3	✓ 2 dBm Steps -40 to -22 and then returned to -36 dBm		
17169 with Unmodified Antenna	2	✓ 2 dBm Steps -40 to -22 and then returned to -36 dBm		
17169 with modified Antenna	2	✓ 2 dBm Steps -40 to -22 and then returned to -36 dBm		
17169 with Unmodified Antenna	3	✓ 2 dBm Steps -47 to -27 and then returned to -36 dBm		
17169 with modified Antenna	3	✓ 2 dBm Steps -47, -15 and -10		

ATTACHMENT B
(Tracking with a Simulated GPS Signal)

Tracking Test Summary

Device	Configuration	Power @ Device dbm 1 C/No change Un-modified Ant	Power @ Device dbm 1 C/No change Modified Ant.	Notes:
12586 &17641	LTE Only	-29	No Change @ -15dbm	spreadsheet
	Handset Only (Both 1632.5 and 1651.7 MHZ)	-32	No Change @ -15dbm	
	LTE and Handset		No Change @ -15dbm	
	Live Satellite LTE Only		No Change @ -5dbm	
17169	LTE Only	-29	No Change @ -5dbm	
	Handset Only (Both 1632.5 and 1651.7 MHZ)	-34.4	No Change at -15 dBm	
	LTE and Handset	2 dB at -37	1.6 dB @ -10.4 dBm	
	Live Satellite LTE Only		No Change @ -5dBm	

Tracking Test Charts of C/No vs Interference Simulated Satellite - Base Station Signal (Configuration 1)



1. Java Unit - Simulated GPS signal (started at -35 dBm, went to -10 dBm and and them returned to -35 dBm)

C/No Unmodified Ant-12867	C/No Modified – Ant-11207	PWR @ Device (dBm)
47	48	-35.00
47	48	-33.00
47	48	-31.00
46	48	-29.00
46	48	-27.00
44	48	-25.00
42	48	-23.00
38	48	-21.00
36	48	-19.00
32	48	-17.00
LOL * Note 1	48	-15.00
LOL	48	-13.00
LOL	48	-11.00
LOL	48	-10.00 Note 2
LOL	48	-11.00 Note 3
LOL	48	-13.00
LOL	48	-15.00
LOL	48	-17.00
LOL	48	-19.00
LOL	48	-21.00
42	48	-23.00
45	48	-25.00
46	48	-27.00
47	48	-29.00
47	48	-31.00
47	48	-33.00
47	48	-35.00

Note 1 – LOL indicates where the GPS units lost the GPS signal.

Note 2 - -10 dBm at the device is the maximum interference signal tested.

Note 3 – The interference signal was reduced to determine at what level the DUT signal would reacquire the DUT signal.

2. 17169

A. Simulated GPS with a constant GPS signal. Data also shows hysteresis performance for the unit connected to the unmodified antenna.

UNMODIFIED ANT -		Modified Antenna-	
GPS Status	PWR @ Device (dBm)	GPS Status	PWR @ Device (dBm)
Lock	-35	Lock	-35
Lock	-33	Lock	-30
Lock	-31	Lock	-5
Lock	-29		
Lock	-27		
Lock	-25		
Lock	-23		
Lock	-21		
LOL	-19		
LOL	-21		
LOL	-23		
LOL	-25		
Mostly Back	-27		
All Back	-29		
Lock	-31		
Lock	-33		
Lock	-35		

NOTE 1 - Signal was reduced until Loss of Lock (LOL) was obtained on the unmodified antenna. The signal was then increased until all satellites were reacquired.

NOTE 2 - For the modified antenna, only four signal levels were used based on previous test results which showed the modified antenna was not affected at the lower signal levels.

GPS Satellites (9)										Geo	XYZ	Target	GLONASS Satellites (0)											
#	EL	AZ	CA	P1	P2	2C	TC	SS					Sr	Fr	EL	AZ	CA	P1	P2	2C	TC	SS		
07	66+	96	45	32	32		12	00+	Lat: 30° 14' 59.9999" N															
08	62+	340	45	32	32		12	00+	Lon: 76° 25' 00.0007" W															
11	40+	116	45	32	32		12	00+	Alt: 1.5353 m															
13	24+	178	45	32	32		13	00+	Vel: 0.0227 m/s															
17	29+	214	45	32	32		12	00+	RMS Pos: 2.6887 m															
19	32+	44	45	33	33		12	00+	RMS Vel: 0.0308 m/s															
25	46+	120	45	33	33		12	00+	PDOP: 1.9150															
26	11+	320	46	32	32		12	00+	(standalone)															
28	44+	296	45	33	33		12	00+	Receiver time: 13:12:55															
									Receiver date: 11/21/2011															
									Clock offset: -0.1202 ppm															
									Osc. offset: -0.2327 ppm															
									Tracking time: 01:52:21															

CDM11, 115200

01:50:20

GPS Satellites (9)									GLONASS Satellites (0)															
#	EL	AZ	CA	P1	P2	2C	TC	SS	Geo	XYZ	Target	Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS			
07	66--	98	45	32	32		14	00+	Lat: 30° 14' 59.999"N Lon: 76° 25' 00.0004"W Alt: 1.5168 m Vel: 0.0090 m/s RMS Pos: 2.6771 m RMS Vel: 0.0313 m/s PDOP: 1.9071 (standalone)															
08	63+	340	45	32	32		14	00+																
11	40+	114	45	32	32		14	00+																
13	23--	178	45	32	32		14	00+																
17	30+	216	45	32	32		14	00+																
19	31--	44	45	32	32		14	00+																
25	48--	122	45	32	32		14	00+																
26	12+	318	45	32	32		14	00+																
28	45+	296	45	32	32		14	00+																
									Receiver time: 13:14:52 Receiver date: 11/21/2011 Clock offset: -0.1199 ppm Osc. offset: -0.2324 ppm Tracking time: 01:54:18															

COM11, 115200

01:52:17

Interference Level -31dbm @ device

[illegible]

Interference Level -29dbm @ device

File Configuration Tools Plots Help									Geo XYZ Target		GLONASS Satellites (0)															
GPS Satellites (9)																										
#	EL	AZ	CA	P1	P2	2C	TC	SS	Lat: 30° 14' 59.9996" N	Lon: 76° 25' 00.0010" W	Alt: 1.5280 m	Vel: 0.0054 m/s	RMS Pos: 2.6453 m	RMS Vel: 0.0319 m/s	PDOP: 1.8836	(standalone)	Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS
07	64+	102	45	32	32		19	00+																		
08	65+	342	44	32	31		19	00+																		
11	41+	112	44	32	31		19	00+																		
13	22+	178	45	32	32		19	00+																		
17	32+	216	44	32	32		19	00+																		
19	30+	42	44	32	32		19	00+																		
25	46+	124	44	32	31		19	00+																		
26	13+	318	45	32	32		19	00+																		
28	45+	298	45	32	32		19	00+																		
									Receiver time: 13:18:58																	
									Receiver date: 11/21/2011																	
									Clock offset: -0.1132 ppm																	
									Osc. offset: -0.2317 ppm																	
									Tracking time: 01:58:24																	

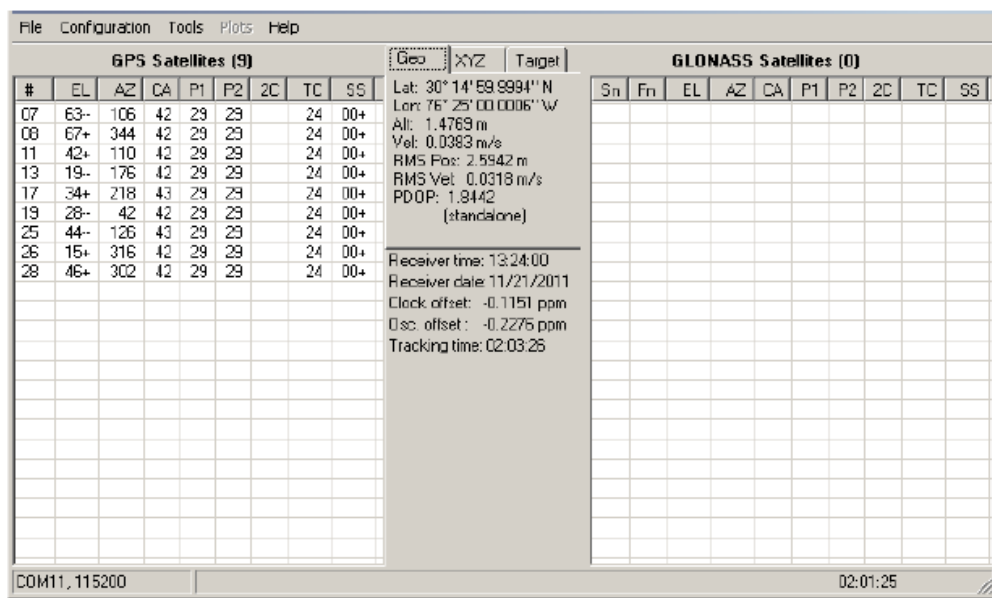
Interference Level -27dbm @ device

File Configuration Tools Ports Help

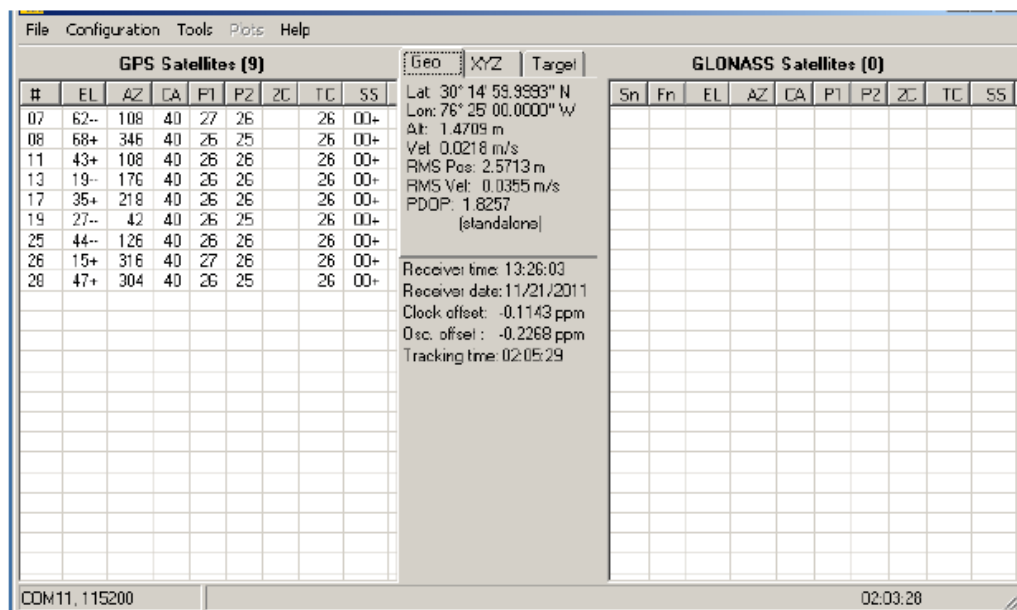
GPS Satellites (9)

#	EL	AZ	CA	P1	P2	2C	TC	SS
07	64+	104	44	31	31		21	00+
08	66+	344	44	31	31		21	00+
11	42+	112	44	31	30		21	00+
13	21+	178	44	31	31		21	00+
17	33+	216	44	31	31		21	00+
19	29+	42	44	31	31		21	00+
25	45+	124	44	31	31		21	00+
26	14+	318	44	31	31		21	00+
28	46+	300	44	31	31		21	00+

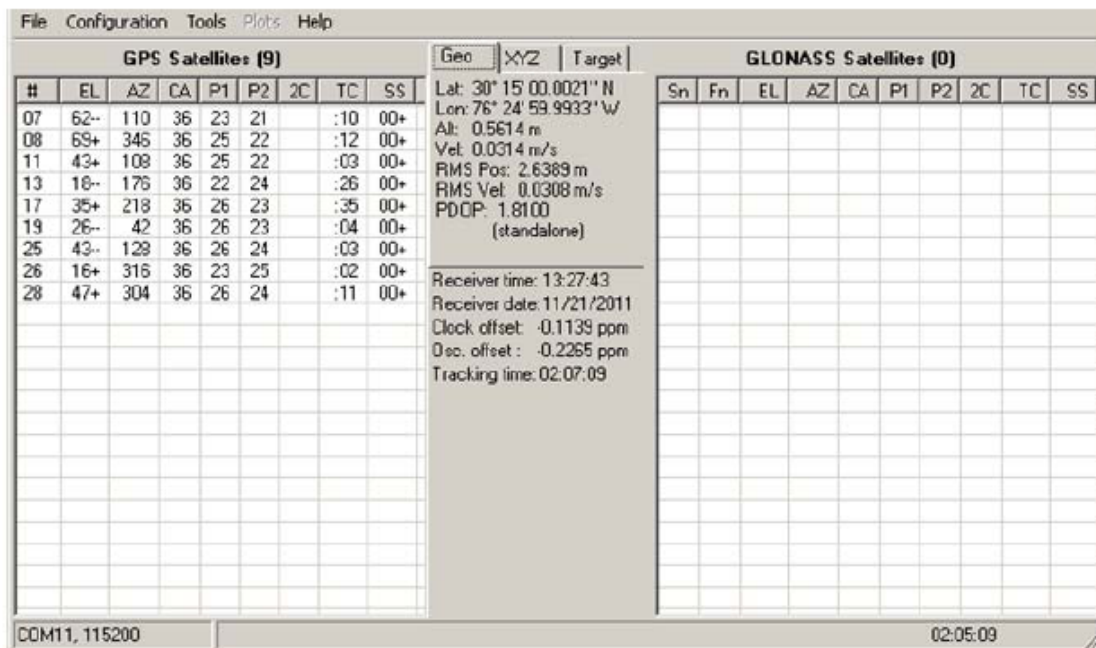
Interference Level -25dbm @ device



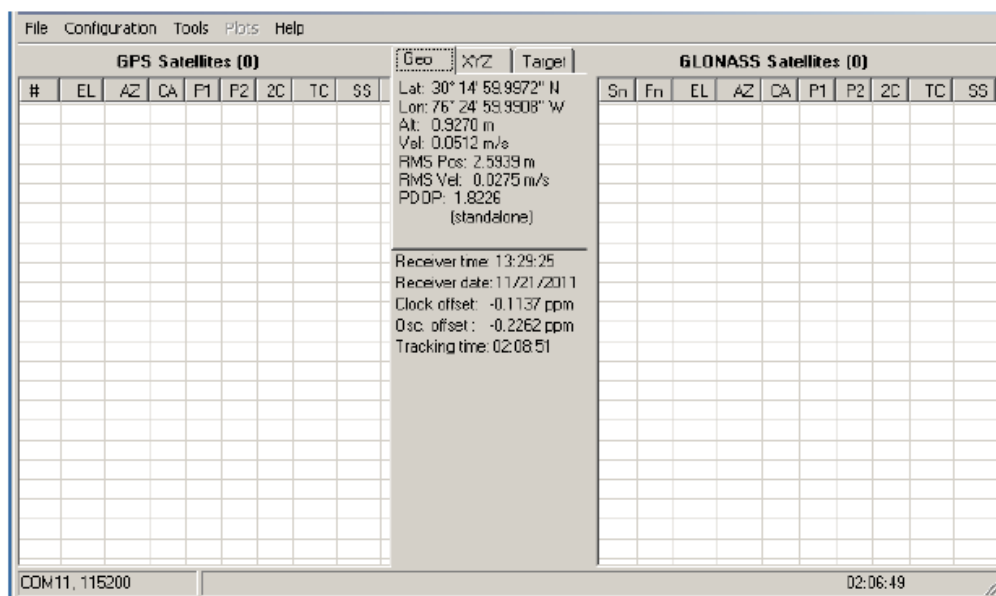
Interference Level -23dbm @ device



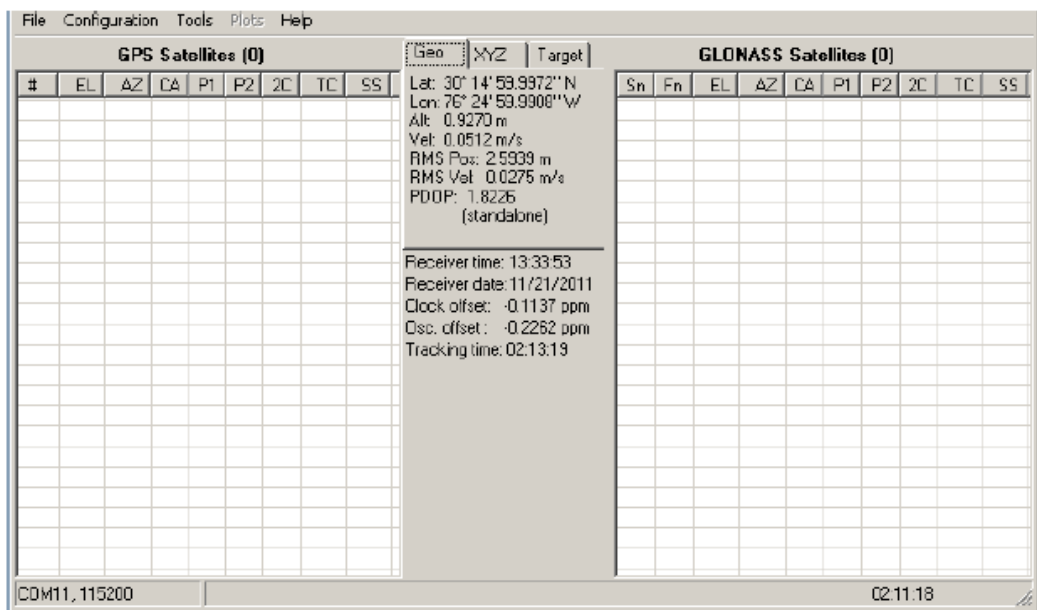
Interference Level -21dbm @ device



Interference Level -19dbm @ device



Interference Level -21dbm @ device



Interference Level -23dbm @ device

File Configuration Tools Plots Help

GPS Satellites (0)

#	EL	AZ	CA	P1	P2	2C	TC	SS
							</	

Interference Level -27dbm @ device

File Configuration Tools Plots Help

GPS Satellites (9)

#	EL	AZ	CA	P1	P2	2C	TC	SS
07	58+	118	44	31	31		2	00+
08	74+	354	44	31	31		2	00+
11	45+	100	44	31	31		2	00+
13	13+	176	44	31	31		2	00+
17	41+	222	44	18	16		2	00+
19	22+	42	44	31	31		2	00+
25	38+	132	44	31	31		2	00+
26	19+	312	44	31	31		2	00+
28	49+	312	44	31	31		2	00+

Interference Level -29dbm @ device

File Configuration Tools Plots Help

GPS Satellites (9)

#	EL	AZ	CA	P1	P2	2C	TC	SS
07	57+	120	44	32	32		3	00+
08	75+	356	45	32	32		3	00+
11	45+	98	44	32	32		3	00+
13	12+	176	44	32	32		3	00+
17	41+	222	45	32	32		3	00+
19	21+	42	44	32	32		4	00+
25	37+	132	45	32	32		3	00+
26	19+	310	44	32	32		4	00+
28	50+	312	44	32	32		3	00+

Interference Level -31dbm @ device

GPS Satellites (10)										Geo	XYZ	Target	GLONASS Satellites (0)															
#	EL	AZ	CA	P1	P2	2C	TC	SS		Lat: 30° 15' 00.0006"N	Lon: 76° 25' 00.0002"W	Alt: 1.5109 m	Vel: 0.0096 m/s	RMS Pos: 2.0750 m	RMS Vel: 0.0240 m/s	PDOP: 1.4792	(standalone)		Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS
07	56-	120	45	32	32		5	00+																				
08	75+	356	45	32	32		5	00+																				
11	45+	98	44	32	32		5	00+																				
13	12-	174	44	32	32		5	00+																				
15	5+	322	45	32	32		59	00+																				
17	42+	224	45	32	32		5	00+																				
19	20-	42	45	32	32		5	00+																				
25	37-	132	45	32	32		5	00+																				
26	19+	310	44	32	32		5	00+																				
28	50+	314	44	32	32		5	00+																				
										Receiver time: 13:42:55																		
										Receiver date: 11/21/2011																		
										Clock offset: -0.1049 ppm																		
										Osc. offset: -0.2174 ppm																		
										Tracking time: 02:22:21																		

D. 17169 Unit with modified antenna with interference.

Interference Level -35dbm @ device

File Configuration Tools Plots Help

GPS Satellites (10)

#	EL	AZ	CA	P1	P2	2C	TC	SS
03	28-	44	47	34	34		30	00+
06	15-	40	46	34	34		30	00+
07	64+	4	46	34	34		30	00+
08	35+	316	46	34	34		30	00+
11	17+	144	47	34	34		30	00+
13	59-	184	46	34	34		30	00+
19	56-	74	47	34	34		30	00+
23	31-	166	46	34	34		30	00+
25	66-	58	47	34	34		30	00+
28	27+	260	46	34	34		30	00+

GeoXYZTarget

Lat: 30° 14' 59.9996" N
Lon: 76° 24' 59.9998" W
Alt: 1.4697 m
Vel: 0.0077 m/s
RMS Pos: 2.2450 m
RMS Vel: 0.0249 m/s
PDOP: 1.5991
(standalone)

Receiver time: 12:00:53
Receiver date: 11/21/2011
Clock offset: -0.0777 ppm
Osc. offset: -0.1902 ppm
Tracking time: 00:40:19

GLONASS Satellites (0)

Sn	Fa	EL	AZ	CA	P1	P2	2C	TC	SS

Interference Level -30dbm @ device

File Configuration Tools Plots Help

GPS Satellites (10)									Geo			XYZ	Target	GLONASS Satellites (0)											
#	EL	AZ	CA	P1	P2	2C	TC	SS						Sn	Fa	EL	AZ	CA	P1	P2	2C	TC	SS		
03	27-	44	46	34	34		32	00+	Lat: 30° 14' 59.9996" N																
06	14-	40	46	34	34		32	00+	Lon: 76° 24' 59.9998" W																
07	64+	6	46	34	34		32	00+	Alt: 1.4606 m																
08	36+	316	46	34	34		32	00+	Vel: 0.0297 m/s																
11	18+	144	46	34	34		32	00+	RMS Pos: 2.2452 m																
13	58-	184	46	34	34		32	00+	RMS Vel: 0.0264 m/s																
19	55-	74	46	34	34		32	00+	PDP: 1.6003																
23	30-	166	46	34	34		32	00+	(standalone)																
25	66-	50	46	34	34		32	00+	Receiver time: 12:03:00																
28	27+	260	46	34	34		32	00+	Receiver date: 11/21/2011																
									Clock offset: -0.0777 ppm																
									Osc. offset: -0.1903 ppm																
									Tracking time: 00:42:25																
COM11, 115200									00:40:25																

Interference Level -5dbm @ device

File Configuration Tools *Plas* Help

GPS Satellites (10)

#	EL	AZ	CA	P1	P2	2C	TC	SS
03	25-	42	46	34	34		37	00+
06	13-	40	46	34	34		37	00+
07	65+	10	46	34	34		37	00+
08	37+	318	47	34	34		37	00+
11	19+	142	47	34	34		37	00+
13	55-	184	46	34	34		37	00+
19	54-	70	47	34	34		37	00+
23	28-	166	46	34	34		37	00+
25	65-	66	46	34	34		37	00+
28	29+	262	46	34	34		37	00+

GeoXYZTarget

Lat: 30° 14' 59.9988" N
Lon: 76° 25' 00.0000" W
Alt: 1.4616 m
Vel: 0.0045 m/s
RMS Pos: 2.2486 m
RMS Vel: 0.0255 m/s
PDOP: 1.5996
(standalone)

Receiver time: 12:07:52
Receiver date: 11/21/2011
Clock offset: -0.0782 ppm
Osc. offset: -0.1907 ppm
Tracking time: 00:47:18

GLONASS Satellites (0)

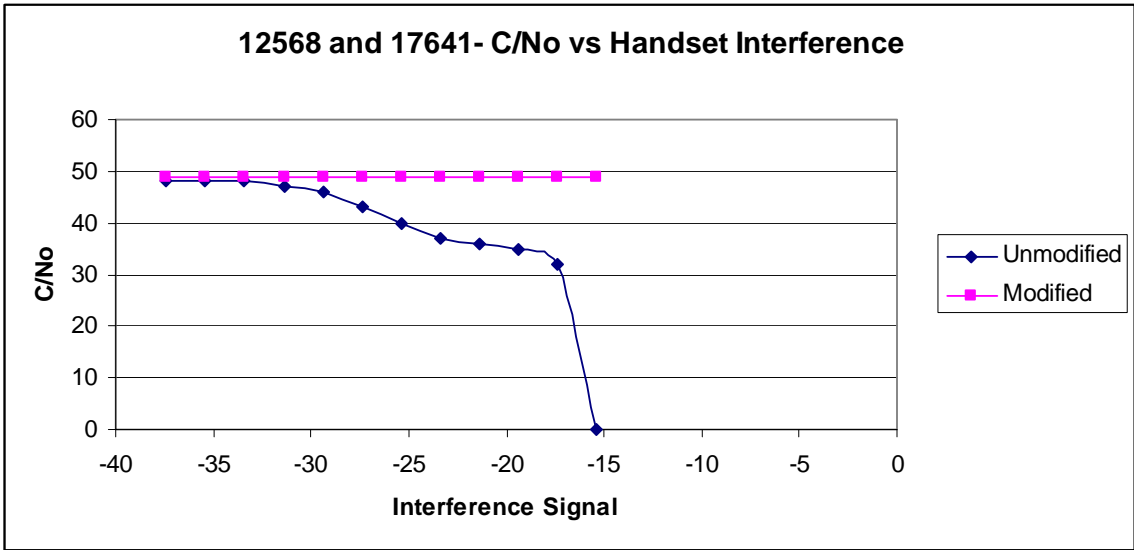
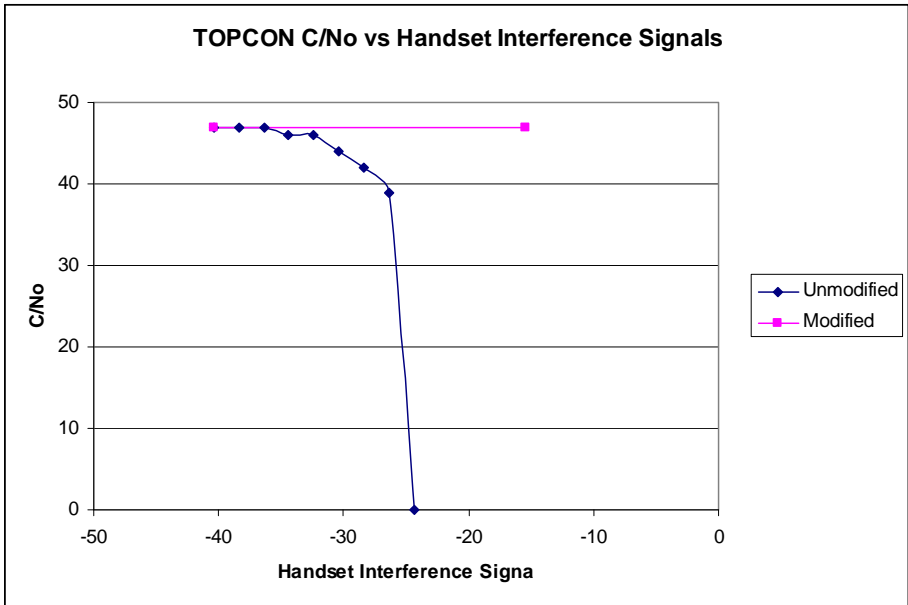
Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS

ATTACHMENT C

(Tracking – Uplink)

TRACKING – Handset
(UPLINK- 1632.5 and 1651.7MHz Combined Signal)

1. Charts of C/No vs the handset interfering signals (1632.5 and 1651.7 Combined)



2. 17169 – Handset Interfering Signal (Combined 1632.5 and 1651.7)

GPS Status	PWR @ Device (dBm)
47	-40.4
47	-38.4
47	-36.4
46	-34.4
46	-32.4
44	-30.4
42	-28.4
39	-26.4
LOL	-24.4
LOL	-22.4
LOL	-24.4
LOL	-26.4
LOL	-28.4
44	-30.4
46	-32.4
46	-34.4
47	-36.4

GPS Status	PWR @ Device (dBm)
47	-40.4
47	-15.4

3. 12586 AND 17641 – Handset Interfering Signal (Combined 1632.5 and 1651.7)

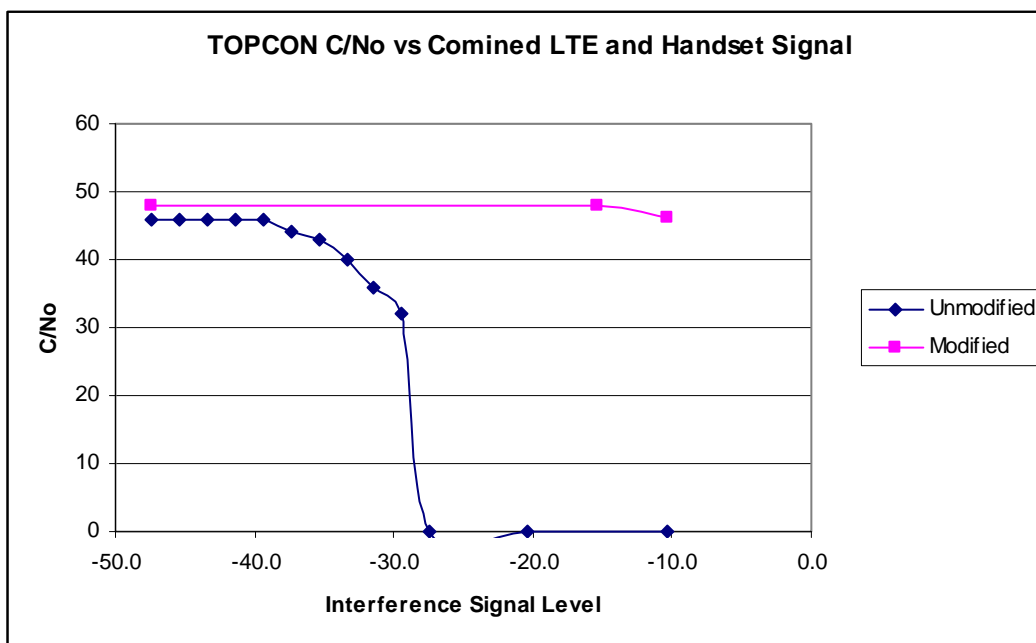
GPS Status	PWR @ Device (dBm)
48	-37.40
48	-35.40
48	-33.40
47	-31.40
46	-29.40
43	-27.40
40	-25.40
37	-23.40
36	-21.40
35	-19.40
32	-17.40
0	-15.40
0	-17.4
0	-19.40
0	-21.4
0	-23.40
0	-25.4
0 (Located	
2)	-27.4
46	-29.40
48	-31.4
48	-33.40
48	-35.4
48	-37.4

GPS Status	PWR @ Device (dBm)
49	-37.40
49	-35.40
49	-33.40
49	-31.40
49	-29.40
49	-27.40
49	-25.40
49	-23.40
49	-21.40
49	-19.40
49	-17.40
49	-15.40

ATTACHMENT D
(Tracking – Combined LTE and Handset Signals)

TRACKING – LTE and Handset Signals Combined

1. Charts of C/No vs the combined LTE and handset interfering signals



2. 17169 – LTE and Handset Interfering Signals combined

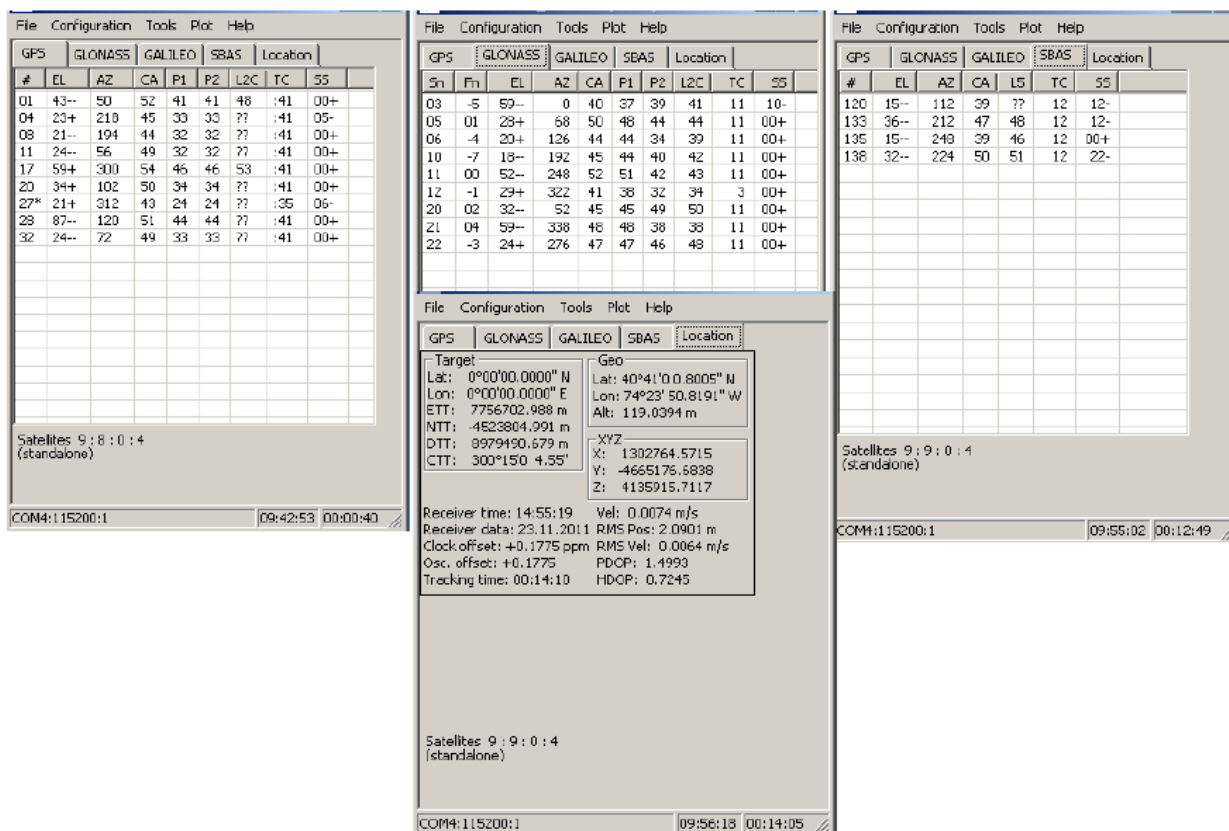
GPS Status	PWR @ Device (dBm) HDST	PWR @ Device (dBm) HDST
46	-30.0	-47.4
46	-30.0	-45.4
46	-30.0	-43.4
46	-30.0	-41.4
46	-30.0	-39.4
44	-30.0	-37.4
43	-30.0	-35.4
40	-30.0	-33.4
36	-30.0	-31.4
32	-30.0	-29.4
lol	-30.0	-27.4
lol	-30.0	-29.4
lol	-30.0	-31.4
lol	-30.0	-33.4
43	-30.0	-35.4
44.5	-30.0	-37.4
45	-30.0	-39.4
46	-30.0	-41.4
46	-30.0	-43.4
46	-30.0	-45.4
46	-30.0	-47.4

GPS Status	PWR@ Device (dBm) LTE	PWR@ Device (dBm) HDST
47.8	-15.0	-47.4
47.8	-15.0	-15.4
46.2	-10.0	-10.4

ATTACHMENT E
(Live Satellite Tracking – Base Station)

17169 GPS with Modified Antenna

No Interference



Interference -30dBm

[illegible]

Interference -20dBm

[illegible]

Interference -15dBm

[illegible]

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PROPRIETARY -Use pursuant to Company instructions

File				Configuration		Tools		Plot		Help	
GPS		GLONASS		GALILEO		SBAS		Location			
Target Lat: 0°00'00.0000" N Lon: 0°00'00.0000" E ETT: 7756703.058 m NTT: -4523805.365 m DTT: 8979490.927 m CTT: 300°15'0 4.56"						Geo Lat: 40°41'0 0.8126" N Lon: 74°23' 50.8245" W Alt: 118.9497 m XYZ X: 1302764.3671 Y: -4665176.4178 Z: 4135915.9359					
Receiver time: 14:57:39						Vel: 0.0041 m/s					
Receiver data: 23.11.2011						RMS Pos: 1.9960 m					
Clock offset: +0.1780 ppm						RMS Vel: 0.0079 m/s					
Osc. offset: +0.1780						PDOP: 1.4902					
Tracking time: 00:16:30						HDOP: 0.7267					
Satellites 9 : 9 : 0 : 4 (standalone)											
COM4:115200:1						09:58:38		00:16:25			

ATTACHMENT F
(Acquisition)

ACQUISITION
(max time 3 minutes)

1. 12586 and 17641 Units using a modified antenna and an unmodified antenna

LTE PWR @ device (dBm)	Time (Seconds)		Field V/M
	Unmodified Ant	Modified Ant	
-30	8	8	
-24	20	10	
-20	FTA	15	1.04
-14	FTA	12	2.4

*FTA- Failed to Acquire Signal

2. 17169 unit –tested with constant signal from simulator. Tested with a unmodified and modified antenna.

LTE PWR at device (dBm)	Time (Seconds)		Field V/M
	Unmodified Ant	Modified Ant	
Baseline	2	5	
-30	8	29	
-24	55	130	
-20	DNFA	85	0.96
-15	DNA	80	2.2

*DNA- Failed to Acquire Signal

*DNFA - Did not fully acquire all Sats within 3 minutes

ATTACHMENT G

Sensitivity Testing
(Satellite Signal Reduced)

Sensitivity Test Summary

12586 AND 17641 GPS Devices

Interference Level	GPS Power Levels													
	-130 dBm		-135 dBm		-137dBm		-140		-145		-150		-155	
	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod
No Int	47	48	-4	-4	-6	-5	-8	-7					LOL	-23
-30	47	48	-4	-3	-6	-5	-8	-7					LOL	-23
-24	43	48	LOL	-3			LOL	-7					LOL	-23
-15	LOL	48												

17169 GPS Device

Interference Level	GPS Power Levels													
	-130 dBm		-135 dBm		-137dBm		-140		-145		-150		-155	
	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod	UnMod	Mod
No Int	46	46	-4	-3	-6	-4	-7	-7	-14	-12		-16		LOL
-30	45	46	-4	-3		-4		-7	-14	-12		-16		
-24	41	46	-4	-3			-13	-7		-12		-16		
-15		46		-3				-7				-16		

LOL – Loss of Lock

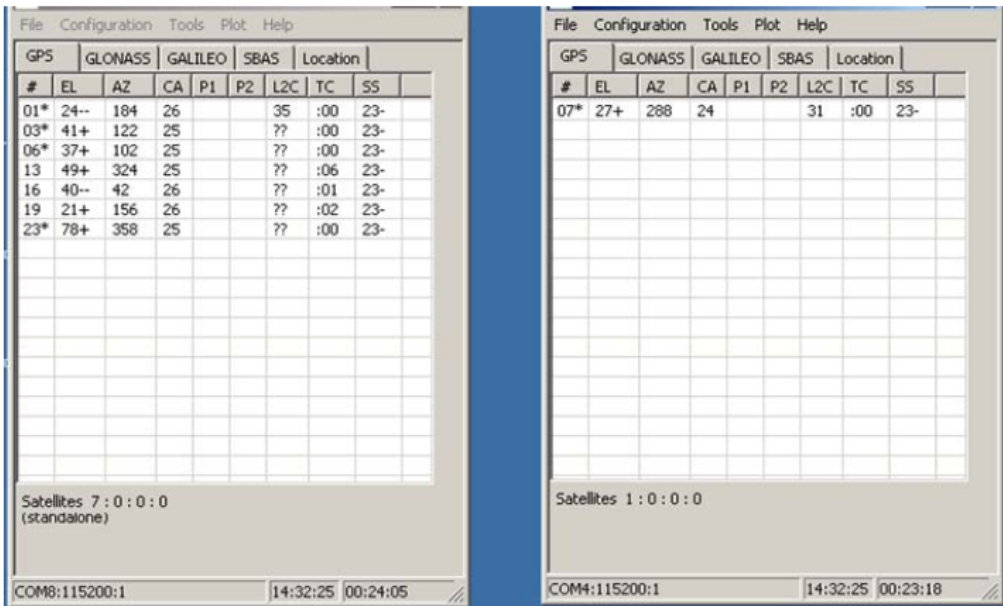
12586 AND 17641 GPS RECEIVER UNITS

Un-Modified

No Interference, $P_{\text{sat}} = -140 \text{ dBm}$

Un-Modified

No Interference, Psat = -155 dBm



Modified

Un-Modified

Modified

Un-Modified

Interference -30dBm, Psat = -140 dBm

Modified

Un-Modified

Un-Modified

Interference -24dBm, Psat = -130 dBm

Un-Modified

Interference -24dBm, Psat = -135 dBm

The figure displays two side-by-side screenshots of a GPS configuration software interface. Both windows have a menu bar with 'File', 'Configuration', 'Tools', 'Plot', and 'Help'.

Left Window (COM8:115200:1):

- Table Headers:** GPS, GLONASS, GALILEO, SBAS, Location, #, EL, AZ, CA, P1, P2, L2C, TC, SS.
- Table Data:**

GPS	GLONASS	GALILEO	SBAS	Location	#	EL	AZ	CA	P1	P2	L2C	TC	SS
					01	45--	190	45	31	31	47	1	00+
					03	26+	140	44	32	32	??	1	00+
					06	26+	124	45	32	32	??	1	18-
					07	16+	270	45	32	32	47	1	18-
					13	30+	316	44	31	31	??	1	18-
					16	59--	54	45	29	29	??	:15	18-
					20	53--	230	45	31	31	??	1	00+
					23	58+	334	44	32	32	??	1	00+
					25	30+	284	44	31	31	47	1	00+
					31	12--	64	45	32	32	47	:39	00+
- Status Bar:** COM8:115200:1 | 16:10:57 | 00:01:12

Right Window (COM4:115200:1):

- Table Headers:** GPS, GLONASS, GALILEO, SBAS, Location, #, EL, AZ, CA, P1, P2, L2C, TC, SS.
- Table Data:** All cells are empty.
- Status Bar:** COM4:115200:1 | 16:10:57 | 00:00:23

Un-Modified

Interference -24dBm, Psat = -140 dBm

The figure displays two side-by-side screenshots of a GPS software interface, likely a serial terminal or a dedicated application. Both windows have a menu bar with 'File', 'Configuration', 'Tools', 'Plot', and 'Help'.

Left Screenshot:

- The 'GPS' window contains a table with the following columns: #, EL, AZ, CA, P1, P2, L2C, TC, SS, and an empty column. The data rows are:

#	EL	AZ	CA	P1	P2	L2C	TC	SS	
01	44--	190	41	26	26	46	2	00+	
03	26+	140	40	26	26	??	2	00+	
06	26+	124	40	26	26	??	2	00+	
07	17+	270	41	26	26	46	2	00+	
13	31+	318	40	26	26	??	2	18-	
16	58--	52	41	26	26	??	1	18-	
20	52--	230	41	26	26	??	2	00+	
23	58+	336	40	26	26	??	2	00+	
25	31+	286	41	26	26	46	2	00+	
31	11--	64	41	26	26	46	1	00+	
- The status bar at the bottom shows 'COM8:115200:1' and a timestamp of '16:12:11 00:02:27'.

Right Screenshot:

- The 'GPS' window contains an empty table with the same column structure as the left window.
- The status bar at the bottom shows 'COM4:115200:1' and a timestamp of '16:12:11 00:01:38'.

1 In-Modified

Un-Modified

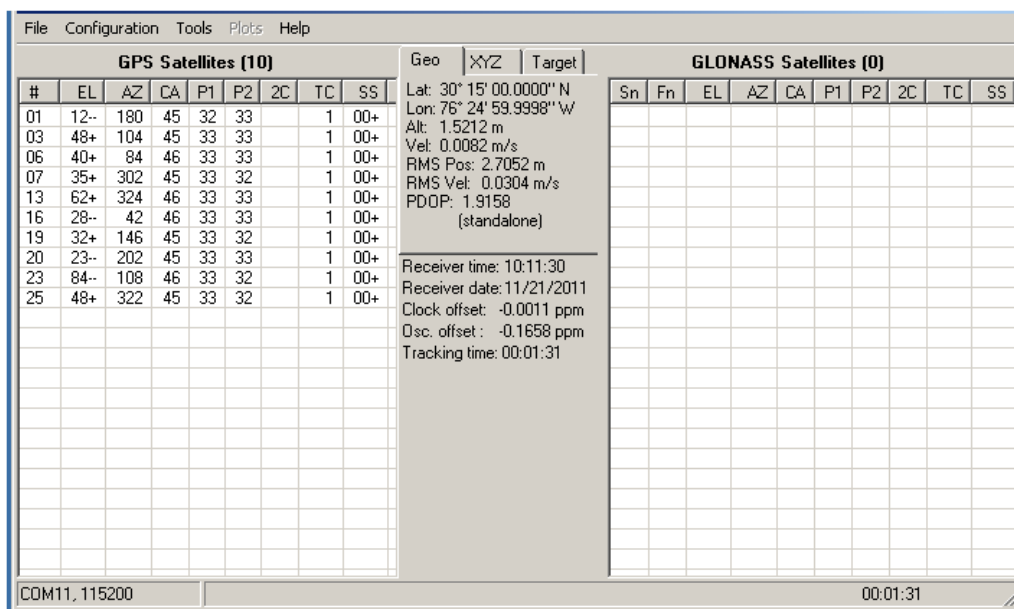
Interference -15dBm Psat=-130dBm

Un-Modified

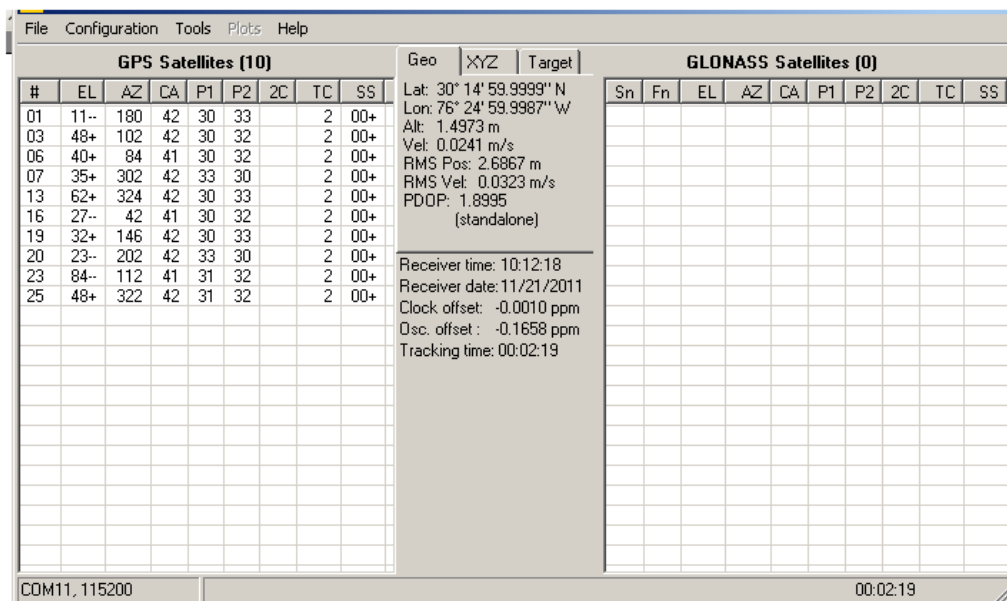
17169 Sensitivity Testing

1. Unmodified Antenna 12867 – with no interference

No Interference, Psat = -130 dBm



No Interference, Psat = -135 dBm



No Interference, $P_{\text{sat}} = -140 \text{ dBm}$

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PROPRIETARY -Use pursuant to Company instructions

No Interference, Psat = -145 dBm

File

Configuration

Tools

Plots

Help

GPS Satellites (11)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	11-	178	32	25	23		:05	00+
03	48+	102	32	24	22		:04	00+
06	40+	84	32	25	23		3	00+
07	35+	302	32	22	25		3	00+
08	5+	280	32	7	8		:06	29-
13	63+	324	32	24	22		3	00+
16	27-	42	32	24	22		:07	00+
19	33+	146	37	24	22		3	00+
20	22-	202	37	22	25		3	00+
23	84-	118	32	25	23		:02	00+
25	49+	324	32	25	23		:04	00+
								</

Interference -30dBm @ device, Psat = -135 dBm

GPS Satellites (11)										GLONASS Satellites (0)									
#	EL	AZ	CA	P1	P2	2C	TC	SS		Sn	Fa	EL	AZ	CA	P1	P2	2C	TC	SS
01	9-	178	41	32	32		2	00+	Geo XYZ Target Lat: 30° 15' 00.0002" N Lon: 76° 24' 59.9999" W Alt: 1.5217 m Vel: 0.0391 m/s RMS Pos: 2.1424 m RMS Vel: 0.0264 m/s PDOP: 1.5206 (standalone) Receiver time: 10:19:11 Receiver date: 11/21/2011 Clock offset: -0.0010 ppm Osc. offset: -0.1657 ppm Tracking time: 00:03:33										
03	49+	98	41	32	32		2	00+											
06	40-	80	41	32	32		2	00+											
07	37+	304	41	32	32		2	00+											
08	6+	282	41	32	32		2	00+											
13	66+	324	41	32	32		2	00+											
16	25-	42	41	32	32		2	00+											
19	35+	144	41	32	32		2	00+											
20	20-	200	41	32	32		2	00+											
23	81-	130	41	32	32		2	00+											
25	50+	326	41	32	32		2	00+											

Interference -30dBm @ device, Psat = -145 dBm

GPS Satellites (10)										GLONASS Satellites (0)									
#	EL	AZ	CA	P1	P2	2C	TC	SS		Sn	Fa	EL	AZ	CA	P1	P2	2C	TC	SS
01	8-	178	31	22	21		:11	00+	Geo XYZ Target Lat: 30° 14' 59.9985" N Lon: 76° 25' 00.0211" W Alt: 0.4561 m Vel: 0.1072 m/s RMS Pos: 2.5552 m RMS Vel: 0.0372 m/s PDOP: 1.7422 (standalone) Receiver time: 10:21:12 Receiver date: 11/21/2011 Clock offset: -0.0012 ppm Osc. offset: -0.1660 ppm Tracking time: 00:05:34										
03	49+	96	31	22	21		:08	00+											
06	40-	78	31	22	21		:04	00+											
07	37+	306	32	22	21		:02	00+											
13	67+	324	31	22	21		:09	00+											
16	24-	42	32	22	21		:02	00+											
19	35+	144	32	21	21		:00	00+											
20	19-	200	31	22	21		:03	00+											
23	80-	134	31	22	21		:03	00+											
25	50+	328	31	22	21		:02	00+											

Interference -24dBm @ device, Psat = -140 dBm

File Configuration Tools Plots Help

GPS Satellites (10)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	6-	178	32	24	21		:01	00+
03	49+	92	32	24	21		:05	00+
06	40-	76	32	24	21		:02	00+
07	38+	308	33	24	21		:03	00+
08	8+	284	32	27	24		:00	00+
16	22--	42	32	24	21		:01	00+
19	37+	142	32	24	21		:11	00+
20	18-	198	33	24	21		:03	00+
23	78-	140	32	24	22		:02	00+
25	51+	330	33	24	21		:02	00+

3. Modified Antenna with no interference

No Interference, $P_{\text{sat}} = -130 \text{ dBm}$

[illegible]

No Interference, $P_{\text{sat}} = -135 \text{ dBm}$

File

Configuration

Tools

Plots

Help

GPS Satellites (11)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	37--	188	43	30	31		12	00+
03	31+	134	43	33	30		12	00+
06	31+	118	43	30	31		12	00+
07	20+	276	43	34	30		12	00+
13	37+	320	43	30	32		12	00+
16	52--	46	43	30	30		12	00+
19	11+	164	43	30	31		12	00+
20	46--	222	44	30	31		12	00+
23	65+	340	43	30	31		12	00+
25	34+	292	43	31	32		12	00+
31	7--	70	44	33	30		12	00+

No Interference, Psat = -145 dBm

File

Configuration

Tools

Plots

Help

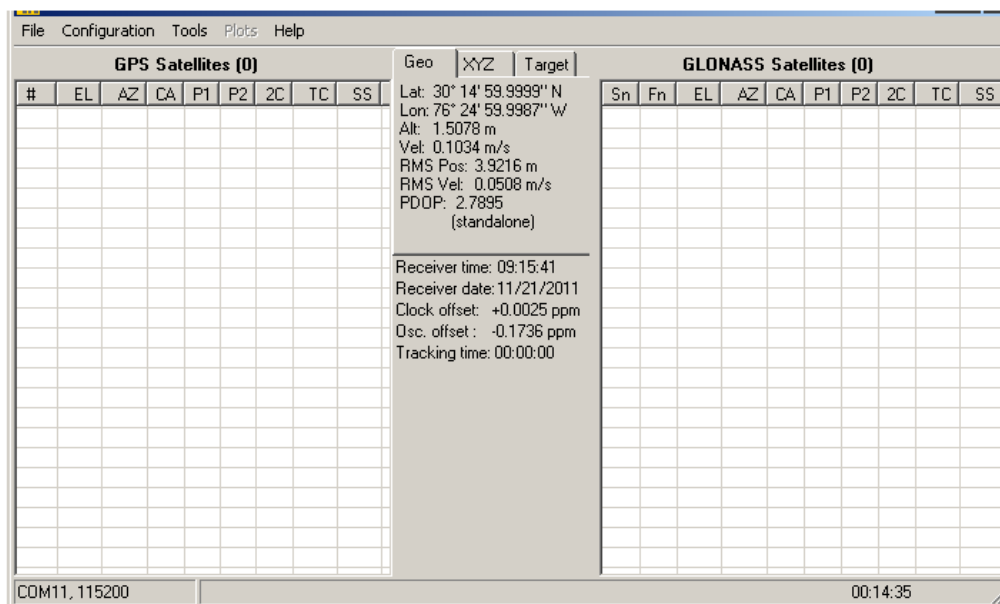
GPS Satellites (11)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	34-	186	34	33	34		1	00+
03	34+	132	34	34	34		:04	00+
06	32+	114	46	34	25		:51	00+
07	22+	280	31	16	15		:45	00+
13	39+	322	34	34	27		:47	00+
16	50-	44	34	34	34		1	00+
19	13+	162	46	34	26		:46	00+
20	44-	218	32	32	34		1	00+
23	68+	344	30	34	34		:35	00+
25	36+	296	31	34	34		:44	00+
31	6-	72	34	34	34		:41	00+

No Interference, Psat = -150 dBm

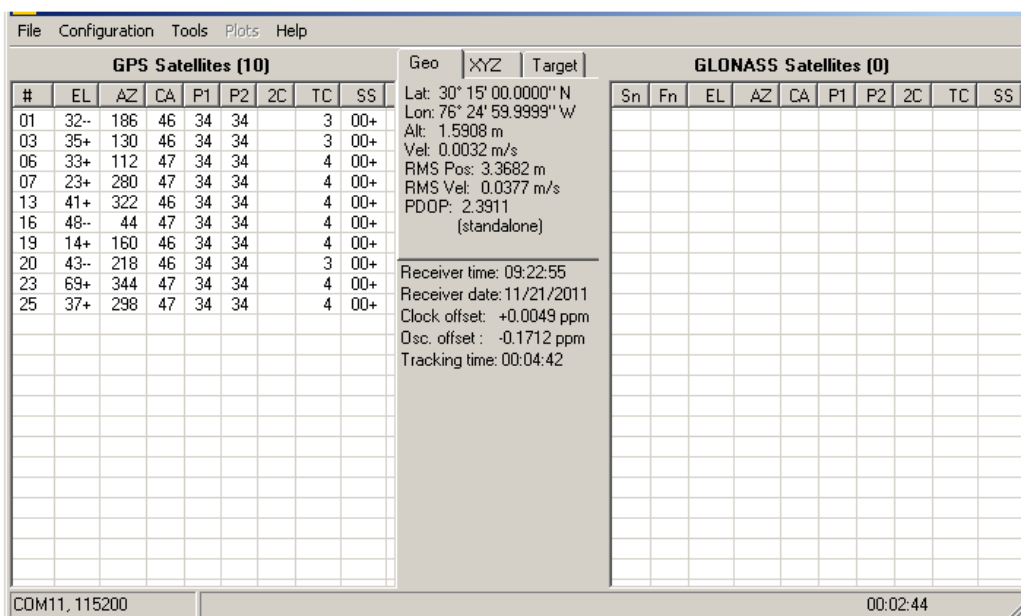
File Configuration Tools Plots Help																							
GPS Satellites (10)									Geo	XYZ	Target	GLONASS Satellites (0)											
#	EL	AZ	CA	P1	P2	2C	TC	SS	Lat: 30° 15' 00.0476" N Lon: 76° 24' 59.9658" W Alt: 11.8348 m Vel: 0.0492 m/s RMS Pos: 4.6951 m RMS Vel: 0.1174 m/s PDOP: 2.3476 (standalone)														
01	24-	184	29	13	13		:03	23-	Receiver time: 09:41:06 Receiver date: 11/21/2011 Clock offset: +0.0020 ppm Osc. offset: -0.1661 ppm Tracking time: 00:01:55														
03	40+	122	29	13	13		:00	23-															
06	37+	104	31	16	16		:00	00+															
07	27+	288	30	16	16		:00	23-															
13	48+	324	30	13	14		:01	23-															
16	41-	42	29	13	14		:00	23-															
19	20+	156	30	16	16		:00	00+															
20	36-	210	30	14	14		:00	23-															
23	77+	356	30	16	16		:01	23-															
25	41+	306	30	15	16		:01	23-															

No Interference, Psat = -155 dBm



4. Modified Antenna with interference

Interference -30 dBm @ device, Psat = -130 dBm



Interference -30dBm @ device, Psat = -135 dBm

[illegible]

Interference -30dBm @ device, Psat = -137 dBm

[illegible]

Interference -30dBm @ device, Psat = -140 dBm

File Configuration Tools Plots Help

GPS Satellites (10)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	31+	186	39	27	27		6	00+
03	36+	130	39	27	27		6	00+
06	34+	112	39	26	27		7	00+
07	24+	282	39	26	26		7	00+
13	42+	322	39	26	27		7	00+
16	47+	44	39	27	27		7	00+
19	15+	160	39	26	27		7	00+
20	41+	216	40	27	27		6	00+
23	71+	346	40	28	25		7	00+
25	37+	298	39	28	27		7	00+

Interference -30dBm @ device, Psat = -145 dBm

File Configuration Tools *Plots* Help

GPS Satellites (10)									Geo	XYZ	Target	GLONASS Satellites (0)										
#	EL	AZ	CA	P1	P2	2C	TC	SS				Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS	
01	30+	186	34	24	18		7	00+	Lat: 30° 15' 00.0000" N Lon: 76° 25' 00.0002" W Alt: 1.4745 m Vel: 0.1062 m/s RMS Pos: 3.5128 m RMS Vel: 0.0405 m/s PDOP: 2.4807 (standalone) Receiver time: 09:27:27 Receiver date: 11/21/2011 Clock offset: +0.0053 ppm Osc. offset: -0.1708 ppm Tracking time: 00:09:14													
03	36+	128	34	23	25		8	00+														
06	34+	110	34	21	25		9	00+														
07	24+	282	34	21	24		8	00+														
13	43+	322	34	21	25		8	00+														
16	46+	44	34	23	25		9	00+														
19	15+	160	34	20	25		8	00+														
20	41+	216	34	24	18		7	00+														
23	71+	348	34	24	21		8	00+														
25	38+	300	34	25	18		8	00+														

Interference -24dBm @ device, Psat = -135 dBm

GPS Satellites (10)										GLONASS Satellites (0)									
#	EL	AZ	CA	P1	P2	2C	TC	SS		Sn	Fa	EL	AZ	CA	P1	P2	2C	TC	SS
01	20-	182	43	30	31		6	00+	Geo: 30° 15' 00.0001" N Lon: 76° 25' 00.0002" W Alt: 1.4279 m Vel: 0.0281 m/s RMS Pos: 3.3712 m RMS Vel: 0.0408 m/s PDOP: 2.4038 (standalone) Receiver time: 09:50:49 Receiver date: 11/21/2011 Clock offset: -0.0012 ppm Osc. offset: -0.1686 ppm Tracking time: 00:07:02										
03	43+	116	43	30	31		6	00+											
06	39+	98	43	31	30		6	00+											
07	30+	292	43	30	31		6	00+											
13	53+	324	43	30	31		6	00+											
16	36-	42	43	30	30		6	00+											
19	24+	154	43	30	31		6	00+											
20	31-	208	44	31	29		6	00+											
23	82+	10	43	30	31		6	00+											
25	43+	312	44	30	31		6	00+											
COM11, 115200										00:06:52									

Interference -24dBm @ device, Psat = -140 dBm

File

Configuration

Tools

Plots

Help

GPS Satellites (10)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	19-	182	39	27	24		8	00+
03	44+	116	39	24	24		8	00+
06	39+	96	39	24	26		8	00+
07	30+	292	39	24	25		8	00+
13	53+	326	39	27	25		8	00+
16	36-	42	39	26	24		8	00+
19	24+	152	39	27	24		8	00+
20	31-	208	39	24	25		8	00+
23	82+	14	39	27	25		8	00+
25	44+	312	39	27	24		8	00+

Interference -24dBm @ device, Psat = -145 dBm

GPS Satellites (10)										GLONASS Satellites (0)												
#	EL	AZ	CA	P1	P2	2C	TC	SS		Geo	XYZ	Target	Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS
01	19--	182	34	24	24		9	00+		Lat: 30° 14' 59.9994" N												
03	44+	114	34	24	24		9	00+		Lon: 76° 25' 00.0024" W												
06	39+	96	35	23	24		9	00+		Alt: 1.5226 m												
07	30+	294	34	24	24		9	00+		Vel: 0.0490 m/s												
13	54+	326	30	24	24		9	00+		RMS Pos: 3.3092 m												
16	35--	42	31	24	23		9	00+		RMS Vel: 0.0621 m/s												
19	25+	152	34	24	24		9	00+		PDOP: 2.3441												
20	30--	206	34	23	24		9	00+		(standalone)												
23	83+	16	34	24	24		:11	00+		Receiver time: 09:53:25												
25	44+	312	33	24	24		9	00+		Receiver date: 11/21/2011												
										Clock offset: -0.0004 ppm												
										Osc. offset: -0.1679 ppm												
										Tracking time: 00:09:38												
COM11, 115200										00:09:28												

Interference -24dBm @ device, Psat = -150 dBm

File Configuration Tools Plots Help

GPS Satellites (9)

#	EL	AZ	CA	P1	P2	2C	TC	SS
01	19-	182	29	19	16		:01	23-
03	44+	114	29	20	16		:06	23-
06	39+	96	30	13	19		:02	23-
07	30+	294	30	20	16		:06	23-
13	54+	326	30	19	17		:01	00+
16	35-	42	30	17	14		:05	23-
19	25+	152	30	20	16		:01	23-
20	30-	206	31	13	18		:02	00+
25	44+	312	30	19	16		:00	00+
				</				

Interference -15dBm @ device Psat=-135 dBm

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Interference -15dBm @ device Psat=-140dBm

File Configuration Tools *Plots* Help

GPS Satellites (10)									Geo	XYZ	Target	GLONASS Satellites (0)									
#	EL	AZ	CA	P1	P2	2C	TC	SS				Sn	Fn	EL	AZ	CA	P1	P2	2C	TC	SS
01	15-	180	39	30	30		6	00+	Lat: 30° 15' 00.0001" N												
03	46+	110	39	26	26		6	00+	Lon: 76° 24' 59.9988" W												
06	40+	92	39	30	25		6	00+	Alt: 1.4093 m												
07	32+	296	40	30	30		6	00+	Vel: 0.0291 m/s												
13	57+	326	40	30	25		6	00+	RMS Pos: 3.0190 m												
16	32-	42	39	30	30		6	00+	RMS Vel: 0.0399 m/s												
19	28+	150	39	26	27		6	00+	PDOP: 2.1435												
20	27-	204	39	30	25		6	00+	(standalone)												
23	65+	50	39	30	30		6	00+	Receiver time: 10:01:32												
25	46+	316	39	30	30		6	00+	Receiver date: 11/21/2011												
									Clock offset: +0.0007 ppm												
									Osc. offset: -0.1668 ppm												
									Tracking time: 00:06:15												

COM11, 115200

00:17:34

Interference -15dBm @ device Psat=-145dBm

File Configuration Tools Plots Help																				
GPS Satellites (10)									Geo	XYZ	Target	GLONASS Satellites (0)								
#	EL	AZ	CA	P1	P2	2C	TC	SS	Lat: 30° 15' 00.0004" N Lon: 76° 24' 59.9987" W Alt: 1.3845 m Vel: 0.0389 m/s RMS Pos: 2.9639 m RMS Vel: 0.0390 m/s PDOP: 2.1056 (standalone)											
01	15-	180	40	24	24		7	00+	Receiver time: 10:03:05											
03	46+	108	39	24	24		7	00+	Receiver date: 11/21/2011											
06	40+	90	39	24	24		7	00+	Clock offset: +0.0005 ppm											
07	33+	298	39	24	24		7	00+	Osc. offset: -0.1669 ppm											
13	58+	326	39	24	24		7	00+	Tracking time: 00:07:48											
16	31-	42	40	24	24		7	00+												
19	28+	150	39	24	24		7	00+												
20	26-	204	40	24	24		7	00+												
23	85+	60	39	24	24		7	00+												
25	46+	318	39	24	24		7	00+												

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